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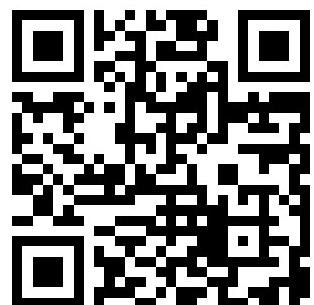
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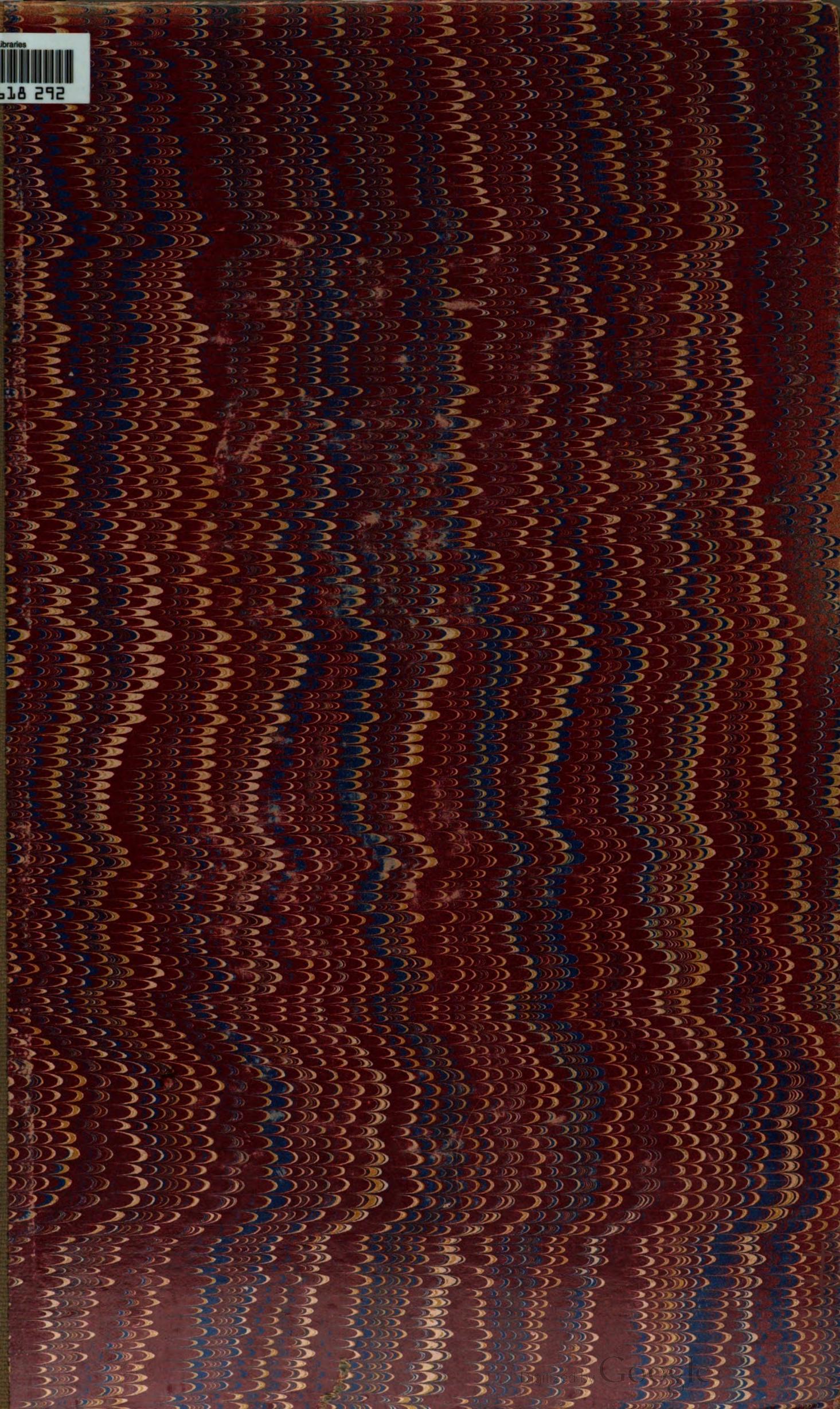
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SUMMARY

TRANSMISSION of power through a submarine cable is being established between Sweden and Denmark. The cable has already been laid across the sound. A pressure of 25,000 volts will be employed (p. 2).

A NUMBER of interesting proposals with regard to municipal wiring have been deposited for the next Parliamentary session. The Lincoln Corporation have a scheme for securing co-operation with contractors. We also give particulars of the electric supply schemes promoted next session in Parliament (p. 3).

THE development committee which was formed at the last Convention of the I.M.E.A. to encourage the use of electricity from public supply mains has commenced its operations (p. 3).

THE Wharncliffe Pit disaster is attributed to a defective coal cutter in the official report, but a prosecution of the management for negligence has failed (p. 4).

A PAPER by Mr. T. J. Nelson, before the Association of Mining Electrical Engineers, reviews precautions for prevention of electrical accidents in mines (p. 4).

THE subject of earth connections in mines is dealt with in a paper by Mr. P. S. Glover before the Association of Mining Electrical Engineers (p. 4).

A CATALOGUE of electric mining apparatus is reviewed (p. 5).

ILLUSTRATED articles describe two forms of electric haulage gear (pp. 5 & 6).

AMONG the mining and metallurgical patents published during last month are two by J. G. Patterson describing details of an electric miners' lamp. Two shaft signalling systems giving visual indications of the signals are also described, and another specification

by O. Oldham is for a complete unlocking and opening apparatus for magnetically locked flame lamps. T. T. Snyder has patented a method of current control for electric furnaces (p. 6).

THE testing of field magnet castings is discussed in our Questions and Answers columns (p. 7).

ONE of the most interesting of the Specifications published at the Patent Office last Thursday is a Marconi patent for an oscillation valve receiver of improved form arranged to be able to respond to continuous oscillations. A patent for tumbler switches by A. P. & G. C. Lundberg, and three Marconi patents expire this week after a life of fourteen years (p. 8).

Two 8,000 kw. turbo-generators are required by the L.C.C.; new mains at Nottingham (£20,000); a transformer station (£18,252) and mains (£25,000) at Salford; services at Worcester; new plant at Woolwich (£32,935); Darlington (£20,000); Birmingham (£97,300); and Belfast (£28,390).—Water-tube boilers, economisers, &c., are required at Tunbridge Wells; electric lamps at Camberwell; and stores at Croydon and Dublin (p. 9).

A BREAKDOWN on a high-tension feeder caused a partial interruption of supply for a quarter-of-an-hour in Glasgow on Saturday.—The duplicate gas-driven generating plant at Accrington is now in operation.—A dispute has arisen between owners of cinematograph theatres and the Electricity Committee at Brighouse.—A scheme for dealing with the contracts for arc lamps on hire, owing to the reduced lighting in London, has been approved at East Ham (p. 10).

AN important report has been prepared by Mr. A. H. Seabrook, General Manager of the Marylebone Electricity Undertaking, upon the L.C.C. Power Bill, which is to be opposed by the Marylebone Council (p. 10).

Arrangements for the Week.—(To-day) Thursday, Jan. 7th.—Greenock Electrical Society, 21 West Stewart Street. "Developments in the Electrical Industry," by D. McDougall. 7.45 p.m.

Saturday, Jan. 9th.—Association of Mining Electrical Engineers, South Wales Branch, Carlton Café, Queen Street, Cardiff. "The Prevention of Electrical Accidents in Mines," by T. J. Nelson. 6 p.m.

Monday, Jan. 11th.—Institution of Mechanical Engineers, Graduates' Section. "Semi-Diesel Engines," by R. A. Pfleiderer.

Tuesday, Jan. 12th.—Institution of Electrical Engineers, Manchester Section. Engineers' Club, 17 Albert Square. "The Shape of the Pressure Wave in Electrical Machinery," by Dr. S. P. Smith and R. S. H. Boulding. 7.30 p.m.

I.E.E. Scottish Section. At Station Hotel, Edinburgh. "Cables," by C. J. Beaver. 8 p.m.

Wednesday, Jan. 13th.—Institution of Electrical Engineers, Yorkshire Section, Philosophical Hall, Leeds. "Automatic Protective Switchgear," by E. B. Wedmore. 7 p.m.

I.E.E., Birmingham Section, University. 7.30 p.m.

Association of Engineers-in-Charge, St. Bride Institute, Fleet Street, E.C. "Electric Accumulators," by R. T. Mitchell.

Thursday, Jan. 14th.—Institution of Electrical Engineers. "The Shape of the Pressure Wave in Electrical Machinery," by Dr. S. P. Smith and R. S. H. Boulding. 8 p.m.

SUBMARINE ELECTRIC POWER TRANSMISSION

DENMARK and Sweden are only separated by about three and a half miles of water at the narrowest part of the Sound. Denmark is without water-power and without coal, while Sweden has both. It is natural, therefore, that the question of transmission of electric power from Sweden to Denmark has long been under consideration. The work of coupling up the two countries in this manner has commenced, and a high-pressure cable has already been laid under the sea across the Sound. It is proposed to employ this experimentally for two or three years, and, if then it is found that the arrangement works, two more cables will be laid, and the electric light and power-supply in Copenhagen, and over an area of nearly 500 square miles, chiefly to the north and west of that city, will gradually be transferred to the new system.

This will be the first instance of a submarine supply of electric light and power for industrial purposes between two countries, although there have been a few cases of electric power transmission from one country to another. It is not generally known that Nancy, Toul, and Verdun get part of their electric power from German Lorraine, or, at any rate, got it before the outbreak of the war; it would, by the way, be interesting to know the present condition of this power transmission. In addition, there is electric power transmission from Silesia (Germany) to Austria, and from the south of Switzerland to Italy. The Rheinfelden works in Switzerland, situated on the Swiss side of the Rhine, supply electric power across the German frontier as well as on the Swiss side of the Rhine, which power would doubtless be declared contraband of war in the event of Switzerland's neutrality not being respected by Germany in the present struggle on the Continent.

The Swedish-Danish power cable is laid from Pälsjö, three miles north of Helsingborg, in Sweden, to a point near Marienlyst just north of Elsinore. (Marienlyst and the castle of Kronborg, between Marienlyst and Elsinore, are supposed, by the way, to be the site of the mythical incidents of the play of Hamlet, and tourists to Marienlyst are shown "Hamlet's grave" and "Ophelia's brook" by enterprising guides.) The submarine cable will carry current at the extremely high pressure of 25,000 volts. It is a three-core cable, each section of the core being 70 sq. mm. (about 0'1 sq. in.). Paper-insulated lead-covered cable is employed with a thickness of 13 mm. (0'51 in.) of insulation between the conductors and also between the conductors and lead. Outside the lead sheathing is an interlocked armouring (Z shaped) 6 mm. thick, bringing the external diameter of the cable to 92 mm. (3'6 ins.), and the weight of the cable to about 57 lbs. per yard. The cable, which is of German manufacture, was delivered in nine lengths of about 650 yds., each on separate drums.

A very simple method has been adopted for joining up the lengths. A lead sleeve-joint filled with compound is employed, and this is surrounded by a steel sleeve 5 ft. long, which has a special arrangement to clamp the armouring in such a way as to withstand the tension on the joint as it is laid down into the water. The steel sleeve is covered with asphalt and wound round with asphalted ribbon, and all the external bolt heads on it are covered with zinc caps filled with an asphalt compound to prevent rust.

The cable was laid and jointed between July 7th and 28th of last year with the assistance of the cable ship *Peter Faber*, belonging to the Danish Telegraph Service. Each drum of cable weighed nearly 20 tons, so only one drum was taken on board at a time, and the cable ship was propelled partly on its own steam and partly with the assistance of a tug. The jointing was carried out on the barge, upon which inverted U-irons were employed to prevent cutting at the edge of the barge. A small hut was erected on the barge to protect the joint against damp. The barge was placed crosswise with the cable for making the joint, and, on the work being completed, the joint was lowered gradually by ropes, leaving sufficient slack for subsequent examination and repairs.

To protect against dragging anchors, a steel cable of about 40 tons breaking stress has been laid parallel to the cables about 110 yds. to the north. This cable contains the telephone wires connecting the Helsingborg and Elsinore transformer stations. The additional high-tension cables, if the first one should prove effective, will each be laid another 110 yds. to the south of the first one. The line of route is parallel to that taken by the Government telegraph cables connecting the two countries, and a distance of about 660 yds. from the nearest of these. As a guide to ships not to anchor near the

cables the position is indicated on both coasts by double landmarks in the ordinary manner, in line with the protecting cable. These landmarks are iron lattice towers 164 ft. high, and covering a ground space of about 13 by 20 ft. White boards are fixed upon the iron structures, and after dark they will be lighted with green revolving lights. The protecting cable, which was made and laid in one length, has an outside diameter of just over 2 ins., and weighs about 20 lbs. per yd. The telephone wires are insulated with gutta percha. Except near the coast the high-tension cables have simply been laid directly in the bed of the sea, but near the coast they are protected with steel tubes dug in as much as possible to protect the cable being damaged by the action of the waves. On the Danish side, from the coast to beyond the Island of Lappen, owing to the water being comparatively shallow (viz., up to about 40 ft. deep), it has been particularly important to dig the cables in deep, for, in unfavourable weather, many small vessels anchor there. The greatest depth of the cables in the Sound is 125 ft.

The general scheme for power transmission is as follows: current will be supplied by the South Swedish Power Co., which was established in 1906 to utilise the power of the River Lagan for supplying towns in the south of Sweden with electricity. This Company has four power stations: one at Majenfors, one at Bassalt, and two at Knäred, all within three or four miles of one another, and 46½ miles north-east of Helsingborg. The aggregate capacity of these stations is 19,000 kw., and their present yearly output is between 50 to 60 million kw. hours. In the near future, however, the entire power available from these stations will be taken up, and arrangements have been made to extend the system. The Company has bought three waterfalls at the town of Lagan, about 12 miles to the west of the existing power station, from which an aggregate of about 7,000 kw. will be available. A 5,000 kw. steam station is being built at Malmö (between 60 and 70 miles south of the Lagan), and, finally, an agreement has been made with the Högenäs & Billesholm Co. to deliver at an intermediate point initially 2,000, and later 7,000, kw. from a station to be built at Ormstorp, utilising a low-grade coal which is mined there; thus, eventually, nearly 40,000 kw. will be available. Power from the Lagan stations is transmitted at 50,000 volts three-phase to the various distributing centres by copper conductors on iron poles, and the more important main cables are duplicated. The Company's network extends from Halmstad in the north to Trelleborg in the south, these two places being about 90 miles apart. The extent of the whole network is nearly 200 miles. The 50,000 volts at which current is transmitted from the stations is stepped down to from 3,000 to 5,000 in the towns and to 20,000 in the country for the distributing networks. The Helsingborg transformer station, from which the submarine cable to Denmark is supplied, is about 9½ miles to the west of Mörarp, at which is a switching station roughly half-way between the extreme north and south points of the Swedish Power Company's network. It is 37 miles from Knäred, from which station it will be supplied. The existing transformer station at Helsingborg is being extended, and additional plant put in to reduce the 50,000 volt-line pressure to 25,000 volts. Current at this pressure is first taken through three miles of underground cable to the coast at Pälsjö, the point from which the submarine cable starts. At the Danish side there are two underground cables about a mile long to a transformer station near Esrom, west of Elsinore, where the pressure will again be raised to 50,000 volts, and the current will be transmitted 20 miles through two three-phase copper lines on iron masts to the chief transformer station at Gentofte, north of Copenhagen. From here four or five new feeders of the North Zealand electricity works will connect up to the chief transformer station, from which, in future, the whole supply in this part of Zealand is to come, so that the Company's existing works at Skovshoved can be shut down. The lines of the North Zealand Co. stretch south almost to Kalvebodstrand, west to Roskilde, north-west to Lillerød, and north to Elsinore, and the total length of the network is nearly 100 miles. Both in the Elsinore and the Gentofte transformer stations current from Sweden will be stepped down to 10,000 volts, so that Elsinore can supply the northern part of the North Zealand network direct at the pressure now used.

All the overhead wires are protected by an earthed wire above them to protect them against atmospheric discharges, and there are, of course, efficient lightning protectors at the transformer stations. For the transmission between the two countries the mains are duplicated both on the Danish and Swedish sides, each set being in itself sufficient to take the full maximum load of 5,000 kw. The underground

cables from the transformer station to the coast are of the same copper section as the submarine cables, but the radial thickness of the insulation is only 11 mm. (0'485 in.), instead of 13 mm. (0'51 in.), and the armouring over the lead is simply the usual iron tape. The external diameter is 78 mm. (3'06 in.), and the weight about 37½ lbs. per yard. As has already been mentioned, the second submarine cable will probably only be laid in a couple of years' time, and after that possibly a third cable. The 50,000-volt overhead line from Elsinore to Gentofte has also not been erected yet. When ultimately the actual transmission of power between the two countries is established, it is still proposed to keep the steam plant of the North Zealand Co. in reserve with sufficient capacity for the whole supply. The above particulars are taken from a Paper recently read by Mr. A. R. Angelo before the Danish Institution of Engineers.

MUNICIPAL WIRING SCHEMES AND OTHER PARLIAMENTARY BILLS

AS we mentioned on p. 617 of our issue for Dec. 3rd, a number of municipalities this year will ask Parliament for wiring powers, etc. We are now able, from the Bills themselves, to give more exact details of what is being proposed.

The Edinburgh Corporation have a clause in their General Powers Bill authorising them to sell and hire directly motors, fittings and apparatus for all purposes for which electric power can be used except lighting. A similar proposal was brought forward by the Electricity Committee last year, but was outvoted and not confirmed by the Corporation, pressure having been brought to bear by the Edinburgh electrical contractors. They are again opposing this time, and a manifesto bearing the names of some hundred firms has been issued.

The Doncaster, Shrewsbury, Plymouth, and South Shields Corporations, and the Lurgan Urban District Council, ask for full wiring and hiring powers, but undertake to enter into agreements with contractors for the wiring of consumers' premises.

The most interesting proposal of all is that of the Lincoln Corporation, which asks for full wiring and hiring powers, with the option of entering into agreements with contractors; but, in a special clause, provision is made for securing co-operation between the Corporation and the electrical contractors in the following terms:—

With the view to securing co-operation between the Corporation and persons carrying on the business of supplying fittings (in this Act called "electrical contractors"), the following provisions shall apply:—

(a) When the Corporation provide showrooms for the purpose of selling or letting fittings, they shall, at the request of any electrical contractor whose shop or place of business is situate within the area of supply of the Corporation, give to him, when practicable, reasonable facilities for enabling his customers whose premises are situate in the said area to attend such showrooms and to inspect the fittings therein.

(b) Any electrical contractor who shall at the express request of the Corporation sell any fittings on their behalf, shall, subject to any agreement which may be made between them, be entitled to receive, out of the purchase money paid to the Corporation, a sum calculated at the rate ordinarily allowed as discount in respect of such fittings by the makers thereof to electrical contractors and based on the amount actually received by the Corporation in respect thereof.

(c) If the Corporation pay a commission to the persons employed by them in respect of the sale or letting of fittings, they shall pay a commission at the same rate and under similar conditions to any electrical contractor upon whose introduction any fittings are sold or let by the Corporation.

(d) The Corporation shall not themselves execute the wiring of private property except between the main of the Corporation and the consumer's meter, but they may enter into contracts for the execution of wiring under sub-section (2) of this section, provided that—

(i) In making any such contracts for wiring, the Corporation shall not in cases where there are more than one electrical contractor whose shop or place of business is situate in their area of supply give any undue preference to any electrical contractors.

(ii) The Corporation shall not be subject to the restrictions contained in division (d) of this sub-section in any case where there is not effective competition between the electrical contractors carrying on business in the area of supply of the Corporation with regard to the execution of contracts on behalf of the Corporation.

(iii) Any question which may arise between the Corporation and any electrical contractor under division (d) of this sub-

section shall be settled by arbitration under the provisions of the Arbitration Act, 1889.

In all these Bills some form of "Bermondsey" clause is inserted, by which the expenditure on this part of the undertaking is to be adjusted in order, as far as possible, to prevent any loss.

In the Lincoln Bill there are two other interesting clauses. One gives the Corporation the right to insist upon certain standards of wiring for various classes of premises, and the other extends the provisions of Section 4 of the Conspiracy and Protection of Property Act to the electricity works employees. In other words, it prohibits them from striking. The North Metropolitan Electric Power Co. promoted a similar clause last year, but withdrew it after considerable protest by labour interests in London.

As in every branch of private Bill legislation for the 1915 session of Parliament, the number of Bills dealing with electric supply, as compared with previous sessions, shows a very considerable diminution. Indeed, there are only two, apart from the wiring Bills mentioned in the preceding column. The first of these is by the Yorkshire Electric Power Co., which revives the scheme (rejected by Parliament last session on a technical point with regard to notices) for giving a supply of electrical energy in those districts where at present there is no authorised distributor. Other clauses in the Bill deal with the conversion of the company's capital by transferring every £10 ordinary share into ten £1 ordinary shares, and every £5 preference share into five £1 preference shares.

The other Bill is by the Stalybridge, Hyde, Mossley & Dukinfield Tramways and Electricity Board, which seeks to extend its area to include Saddleworth, Springhead, and Lees, and also to take in certain small areas in the County of Cheshire.

In addition, it is proposed to take over the Urban Electric Supply Company's generating station at Glossop, and to borrow £5,500 in respect of new generating plant.

THE I.M.E.A. DEVELOPMENT COMMITTEE

THE first meeting of the Development Committee, which was formed at the last convention of the Incorporated Municipal Electrical Association (see ELECTRICAL ENGINEERING, June 25th, 1914, p. 368), held its first meeting at the Institution of Electrical Engineers on Dec. 11th last. It will be remembered that this Committee was formed as a result of a resolution moved by Mr. W. A. Vignoles (Chief Engineer, Grimsby Electricity Department), its object being to deal with any matters tending to encourage the use of electricity from public supply mains. The membership as originally constituted was as follows: Messrs. F. Ayton (Ipswich), J. W. Beauchamp (West Ham), A. S. Blackman (Sunderland), R. A. Chattock (Birmingham), A. C. Cramb (Croydon), Councillor Crowther (Sheffield), J. E. Edgecome (Kingston), S. E. Fedden (Sheffield), F. M. Long (Norwich), Alderman Pearson (Bristol), H. Faraday Proctor (Bristol), H. Richardson (Dundee), T. Roles (Bradford), A. H. Seabrook (Marylebone), Alderman J. P. Smith (Barrow), W. A. Vignoles (Grimsby). The Council of the I.M.E.A. had appointed Mr. W. A. Vignoles as honorary secretary, but on account of his absence on military service this work was taken over temporarily by Mr. J. W. Beauchamp. At the meeting Mr. S. E. Fedden (General Manager, Sheffield Electricity Department) was elected Chairman, and Mr. S. T. Allen (Wolverhampton) and Mr. H. F. Street (Southampton) were elected additional members of the Committee.

It was decided, if possible, to co-opt members representing the various Associations connected with the supply of electricity and allied interests, and the Secretary was instructed to approach these bodies with regard to the election of representatives. It was also decided, as soon as practicable, to form certain sub-committees to deal in a specialised manner with various questions of interest at the present moment. Following a suggestion in a communication from Mr. F. Ayton (Ipswich) it was proposed to form Technical sub-committees with the object of investigating problems of interest which might arise during the year, and with a view if possible to presenting the results in the form of reports, to be discussed at the Annual Convention of the I.M.E.A. Informal discussions were also held with regard to the future policy of the Committee and the objects to which primary attention should be directed. The next meeting will take place in January, when it is hoped that work upon some of the above objects may be put in hand.

A False Description.—A defendant was recently fined £5 and costs in New Zealand for using the letters A.M.I.E.E. after his name without being entitled to do so. The New Zealand Police Offences Act contains specific clauses relating to such offences, for which the maximum penalty is £20.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

THE WHARNECLIFFE PIT DISASTER

THE report of Mr. S. Pope and Mr. T. H. Mottram on the explosion which took place at the Wharnecliffe Silkstone Colliery on May 30th (see ELECTRICAL ENGINEERING, Aug. 6th, p. 442, and Sept. 3rd, p. 482) confirms the finding of the coroner's jury to the effect that the explosion was caused "by the stoppage and restarting of the fan with a defective coal-cutter running at the face." It is further pointed out that the electrically-driven coal-cutter was found in a condition which left no room for doubt that it was running at the moment of the explosion. The defects observable in the coal-cutter put the machine under violent suspicion, whilst the lamps picked up in the area affected by the explosion came through tests at Eskmeals and Leeds University. Moreover, Mr. G. Blake Walker frankly stated in his evidence that in default of any other source of possible ignition being found, he must assume that the ignition took place at the coal-cutting machine. Mr. R. Nelson (H.M. Electrical Inspector of Mines) also stated that it was "impossible to resist the conclusion that the coal-cutter did, in fact, on this occasion fire the gas." This disaster, continues the report, emphasises again the importance of systematic supervision of electrical apparatus. The coal-cutter was not flame-tight. The joint between the commutator box cover and the body of the machine was defective. There was at one place a gap or aperture in the joint measuring half an inch long by about three-sixteenths wide at one end, tapering to nothing at the other, and there was a second gap or aperture of lesser dimensions. There was external indication of the larger aperture. The apertures were the result of some ill-usage of the half-moon plate, a portion of the motor case which had to be removed when an armature was taken out of or put in the machine. It ought not to have been possible for the coal-cutting machine to have got into the condition and be worked in the condition in which it was found. It would have imposed no serious burden upon the electrical staff in addition to the routine weekly inspection, which the evidence showed to have been carried out, to have inspected the machine thoroughly for flame-proofness after every time it was opened out for replacing an armature, and had this been done on the occasion when the new armature was put in on the morning of May 29th, we believe that the defect in the cover would have been seen.

The sequel to the report was the prosecution of the Company and certain officials at Barnsley on Dec. 16th by the Home Office. The charge, however, relating to neglecting to work and maintain the coal-cutter so that there was "no risk of open sparking" was dismissed on the ground that there had been no proof of criminal negligence.

PREVENTION OF ELECTRICAL ACCIDENTS IN MINES

A Paper by Mr. T. J. Nelson with the above title has been read before the South Wales and other Branches of the Association of Mining Electrical Engineers. In order to provide against accidents due to shock, ignition or fire due to electrical causes, it was necessary to provide reliable connection to earth of all outer metallic covers of apparatus, to cover all live parts with good quality insulating material, to use apparatus which had been designed to prevent open sparking, and to avoid the use of inflammable material near electrical apparatus. The Home Office Rules for securing safety were admirable, but there were various properties of electrical plant only influenced indirectly by them. Passing on to matters of detail, the author expressed a preference for vulcanised bitumen over paper cables, at any rate up to 3,000 volts. Among other details, he emphasised that shafted cables should be supported by cleats 25 to 40 yards apart, should be in one length wherever possible, and that underground cables should be suspended by slings which would readily break away when struck by a fall. All cables should be inspected daily. For A.C. work only oil switches should be used, and the following points should receive attention:—There should be satisfactory provision for earthing, and the apparatus should be so constructed that it can be operated with perfect safety by unskilled workmen; substantial

mechanical terminals should be fitted, because soldering is often prohibited in parts of the mine. It should be possible for inspection, cleaning, and repairs to be carried out with safety. This is best achieved by the draw-out type of gear which enables the switch and all its working parts to be withdrawn from the live connections and, if necessary, taken away as a complete piece of apparatus; all joints, tanks, and castings should be made explosion-proof; the oil tank should be clearly marked with the correct oil level, which should allow an ample head of oil over the switch contacts; all sparking tips should be readily renewable.

The author then summed up some of the requirements of mining motors. For coal-cutters he favoured the bar-wound slip-ring induction motor. Coal-cutter trailing cables were preferably not armoured, but should contain a separate earthing conductor. Underground lighting should never be carried out by lamps in series on a medium-pressure supply. Where alternating current was used, he recommended it to be transformed down to 50 volts for lighting purposes. All bells and signalling keys should be in explosion-proof cases. From the point of view of safety, the earthing system was of vital importance. Earth plates should be sunk where the ground was damp, and copper earth-wires should be provided, bonded to the cable armouring at intervals, instead of relying only on the continuity of the armouring. The resistance of the earth circuit which had to be met—not more than twice that of the largest conductor in the system—could easily be measured by means of the "Dueter." For large installations, the author recommended the use of local earths underground in case of the main earth becoming faulty. The Paper concluded with a few words on protective and leakage recording devices.

EARTHING

A PAPER entitled "Surface Earthing at Scottish Mines" has recently been read by Mr. P. S. Glover at the West of Scotland Branch of the Association of Mining Electrical Engineers. He summed up the main features of colliery earthing systems as follows:—All apparatus above and below ground must be earthed at the surface; the metallic covering of cables is the most satisfactory earth conductor, subject to the required conductivity; a separate earth-wire is sometimes considered a valuable addition, and this is particularly so when the pit water is of such a nature as to cause corrosive action in the armouring of the cables; where unarmoured cables are still in use, an independent earth-wire run throughout the pit is a necessity; two or more earth-plates must be installed on the surface; local earth-plates underground may constitute a desirable addition under certain conditions. The Home Office Rules specified that all metallic sheaths, coverings, frames, and bed-plates of generators, transformers, motors, &c., shall be earthed by connection to an earthing system at the surface of the mine, and the memorandum accompanying the rules recommends that the earthing system should be of sufficient capacity, having regard to the current which it may have to disperse, and to the nature of the surface ground and its condition as regards moisture. Two earth-plates properly placed 20 to 30 ft. apart in good surroundings and connected to each other are stated to be nearly twice as efficient as a single earth-plate equal in surface area to the two together. The Board of Trade regulations for electric tramways speak of a maximum resistance of 2 ohms for an earth connection, but the author's experience leads him to believe that in many cases it is impossible, at any rate in colliery work, to obtain anything like so low a figure, and he gives results of tests of carefully-made earth connections varying from 3·8 to 19·0 ohms. The author favours a plain plate of copper or galvanised iron, about 4 ft. square, the copper plate being 1/16th in. to $\frac{1}{4}$ in. thick, and the iron plate $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick. These should be buried vertically in permanent earth at a depth of about 6 ft., and packed hard on each side and under the bottom edge with about 12 in. thickness of broken coke. The position and depth will depend upon local conditions. If a permanently moist position cannot be obtained, a water supply should be carried to each plate, ensuring that the ground is constantly moist.

ELECTRICAL PLANT AND APPARATUS FOR MINES

A COMPREHENSIVE "Bulletin" on Colliery and Mining Machinery (Part II.) has been issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), and forms

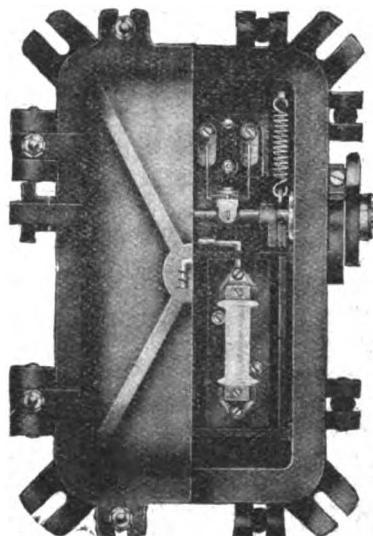


FIG. 1.—15-AMPERE FLAME-PROOF SWITCH WITH "BOBBIN" FUSES.

a catalogue covering a very considerable range of colliery apparatus. Turbine-driven and other generators, motor

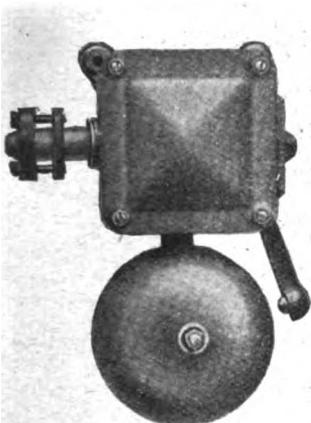


FIG. 2.—FLAME-PROOF BELL.

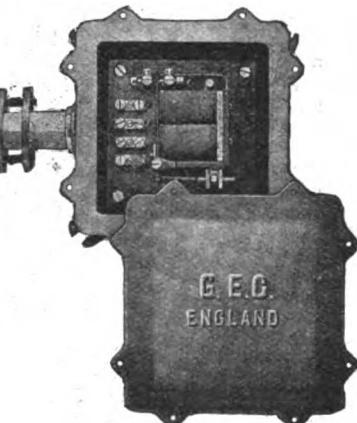


FIG. 3.—FLAME-PROOF RELAY.

rotary converters, &c., are dealt with in the introductory portion, and illustrations give a good idea of the way in

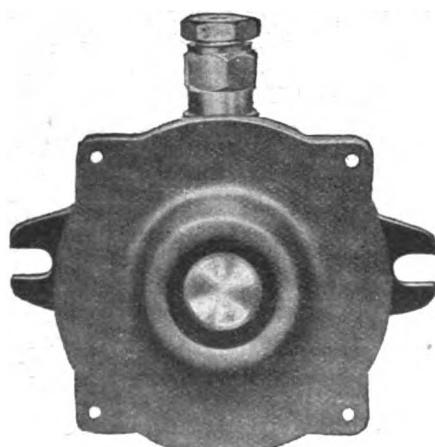


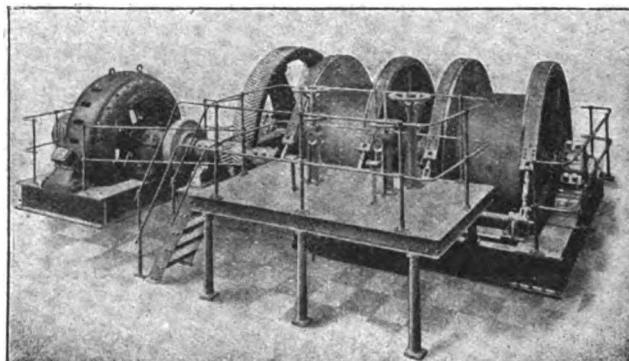
FIG. 4.—FLAME-PROOF RINGING KEY.

which the Company have specialised in mining requirements. Starters and controllers of every class both for fiery and non-

fiery mines are next listed, and there is a long section on ironclad switchgear, ranging from the familiar "Salford" ironclad switches, with or without fuses, to complete high-tension switch units with boiler-plate panels, and the latest refinements of mistake-proof interlocking, and including such special explosion-proof apparatus with broad machined flange joints as is illustrated in Fig. 1. Other features are iron-clad distributing-boards and circuit-breakers. A considerable variety of forms of surge protection apparatus is also listed, and a complete range of switchboard and other instruments is also included. Further items, too numerous to particularise, embrace lighting and traction accessories, ventilating fans, small transformers, arc and incandescent lamps, cables, and porcelain insulators, together with conduit material, fittings, and hand-lamps. Particular attention should be called to the signalling section, which describes the "Kingsway" system of mine signalling, giving visual as well as audible indications as now required by the Home Office Regulations. The Company have a special design of flame-proof bell, as illustrated in Fig. 2. A flame-proof relay and a form of ringing key used in this system of signalling are illustrated in Figs. 3 and 4. This section also contains particulars of luminous indicators, batteries, telephones, &c. The whole publication is very well arranged and illustrated, and should be of great use to mining electrical engineers.

HAULAGE MOTORS

SPECIALISING in the production of motors for colliery work, the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), turn out annually a number of large motors for driving haulage gears both in this country and abroad. A typical example of their recent practice is shown in the accompanying illustration depicting a Witton motor driving a haulage gear supplied to a large North of England colliery. This motor has a capacity of 600 h.p., and is directly coupled to a large main-and-tail haulage gear constructed for drawing its load at a mean rope



600 H.P. WITTON MOTOR DRIVING A MAIN-AND-TAIL HAULAGE GEAR IN A NORTH OF ENGLAND COLLIERY.

speed of ten miles an hour. The motor is supplied by a 3,000 volt, forty-cycle, three-phase circuit, and runs at a speed of 400 r.p.m. Its slip-rings are enclosed in flame-proof covers. The gearing between the motor and the drums is of steel, with machine-cut double helical teeth. The drums are 6 ft. diameter, width between flanges 8 ft., and the diameter of the flanges 9 ft. The drum shaft is 12 in. in diameter. A steel bedplate is provided of special strength. The operator sits upon a separate platform with all the levers in convenient positions.

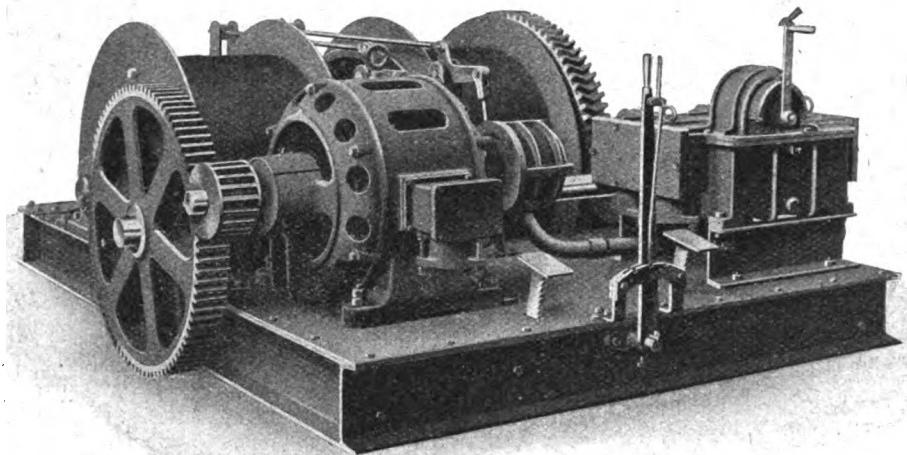
Armoured Cables in Haulage Roads.—An appeal of the Shotts Iron Co. against the decision of the Sheriff at Hamilton, in a recent prosecution for failing to have certain cables along a haulage road protected by a metallic covering, has been dismissed with costs. The original case was referred to in ELECTRICAL ENGINEERING, Nov. 5th, p. 573. It appeared that the cables were originally put in before the date when the new Regulations came into force in another part of the mine, being thus exempt from the regulation, but had lately been moved to the haulage road. The question was whether, owing to this removal, they were to be classed as new work, and not still entitled to exemption. The Sheriff held that this was so, and inflicted a nominal fine of £1 on the company, dismissing the charges against the officials.

ELECTRIC HAULAGE GEAR

WE illustrate here an electric main and tail haulage gear which is one of several types supplied by the Electrical Engineering & Equipment Co., Ltd. (109-111 New Oxford Street, W.C.). These gears are of British manufacture throughout; both the mechanical portion and the electrical equipment are made in the Company's own works. Haulage gears of this and similar types have been supplied to some twenty-four colliery owners throughout the country. The motors are specially designed for haulage work and to withstand rough usage and frequent overload, and, where required, gas-tight motors and controllers complying with

read the number of cells put in circuit by the sending apparatus. This is varied by a dial switch, which is set according to number of rings constituting the signal. A lamp illuminated by the action of a relay can be added to call the driver's attention when a signal is about to be made.

Another mining signal is that described by H. D. Bayley and B. Frogatt, of Bulwell, Notts, in No. 27,709 of 1913. In this apparatus, the pointer of the indicator, with a sector carrying translucent figures to be illuminated from behind, is actuated by an electromagnetic escapement mechanism so that it moves forward one step for every ring of the bell. A recording mechanism is also provided, by which the signals



ELECTRICAL MAIN AND TAIL HAULAGE GEAR.

the Home Office conditions are supplied. The set illustrated is fitted with three-phase motor having flame-proof slip rings and trifurcating box with earthing glands for taking armoured cable. The winding drums are made with mild steel plates. The drum shaft is made hexagonal in the middle, to receive the sliding clutch. The brake gears are of the adjustable post type. They are very powerful and will hold the full load with ease. The gear wheel on the drum shaft is a cast-iron machine-moulded double helical spur wheel which gears into a suitable pinion on the second shaft, and the first motion consists of a machine-cut spur wheel gearing into a raw hide pinion on the motor shaft.

ELECTRICAL MINING AND METALLURGICAL PATENTS OF DECEMBER

Mining.

A NEW form of electric miners' lamp is referred to in Specification No. 25,210 of 1913, by J. G. Patterson, which describes improvements in the construction of the bayonet joint, comprising a ring on the upper part, or lamp cage, having a depending flange, the internal surface of which closely fits the outside of the lamp case, and an outwardly flanged ring screwed to the underside of the upper ring, and carrying outwardly projecting segment pieces at its lower portion for co-operation with inwardly projecting segment pieces fixed within the lamp case. The edge of the flange in this way is spaced from the inner surface of the defending flange so as to form an annular recess for the reception of the upper edge of the lamp case, and makes a flame tight joint. A special form of spring terminal is employed on the accumulator, which is described in Specification No. 21,968 of 1914. A section of the lamp showing the terminal is given in the accompanying illustration.

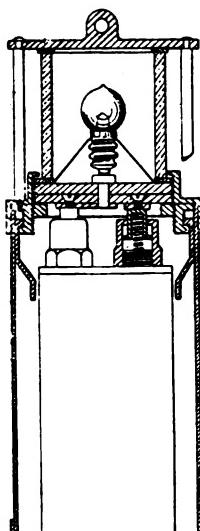
A signalling system designed to give visual indications of shaft signals is described by F. Smith in No. 28,004 of 1913. The indicating instrument takes the form of a large voltmeter, graduated to

are printed on a paper strip continuously driven forward by a clock.

A complete machine for unlocking and opening magnetically-locked flame safety lamps is described in No. 2,249 of 1914 by O. Oldham. The lamp is placed on a circular platform on which it is gripped. It is first unlocked by an adjacent electromagnet, controlled by a foot switch, and the bottom is then unscrewed by rotating the platform by a bevel gear worked by a small crank handle.

Metallurgical.

Specification No. 25,171, of 1913, by T. T. Snyder, details a method of regulating the temperature of an electric furnace and stabilising the arc by providing a resistor having a negative temperature-resistance coefficient, and making the shell of the furnace of laminated steel forming a reactance so proportioned that an increased flow of current above the normal full load will cause a decrease in the energy developed in the furnace.



Home Office Prosecution.—In ELECTRICAL ENGINEERING, Dec. 3rd, p. 619, we referred to a charge brought against the Greenside Mining Co., Ltd., and the manager, Mr. W. H. Borlase, at Hackthorpe, for using an electric locomotive with overhead conductors without the consent of the Home Secretary, which was dismissed on the ground that the special rules in question had not been received. A similar charge was accordingly brought relating to a later date. It appears that the locomotive has been running for 21 years, and the defence stated that when the rules were first sent to the company they gave notice of objection, and then waited for the Home Office to take the next step and to refer the matter to arbitration. Finally, the case was adjourned for three months.

The Case for the Electric Lamp.—In the course of a Paper with this title read recently before the Midland Institute of Mining, Civil and Mechanical Engineers, Mr. W. Maurice summed up the advantages of the electric miners' lamp over the flame safety lamp as follows:—Cleaner coal. Increased output per man, whether engaged in stall- or road-work. Less time lost in starting work. Less time lost in re-lighting lamps. More effective supervision. Enormously diminished risk of firedamp explosions and underground fires. Fewer accidents from falls of roof and side. Fewer haulage accidents. Fewer miscellaneous accidents. Reduction in the number of cases and probably a complete elimination of miners' nystagmus. Reduced cost of insurance and compensation for injuries. More agreeable conditions of labour.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,424.

Explain the method of calculating reactances with iron core and air return circuit, such as are used for feeder protection.—**POSTULATOR.**

(Replies must be received not later than first post Thursday, January 14th.)

ANSWER TO No. 1,422.

Describe a workshop method of testing the permeability of dynamo yokes after machining. The diameter of yoke is about 20 in., and the test is required to show whether the yoke is homogeneous.—**S. K.**

An award of 10s. is given to "L. R." for the following reply :

The best apparatus to use for this purpose is the Drysdale permeameter, in which both the specimen and the greater part of the material form part of the magnetic circuit. In this arrangement a drill of a special form is employed which cuts a circular hole in the specimen, conical at the top, leaving a pin in the centre of it. In the instrument as usually made this hole is $\frac{1}{8}$ in. diameter and $\frac{1}{8}$ in. deep, and the diameter of the pin is 1/10 in., but these dimensions can be changed, the pin often being as small as 1/20 in. diameter, and the drilling 1 in. deep instead of $\frac{1}{8}$ in. These latter dimensions give as great a ratio of length to diameter as is used in the ordinary yoke permeameters. The testing arrangement comprises a soft iron plug carrying a bobbin on which are wound two coils, viz., a magnetising coil and a search coil. The plug is split and is turned slightly conical on its outer surface, the drill cutting the cone of the same angle as that of the plug. By drilling the hole as described and inserting the plug a miniature permeameter is produced which has an exceedingly good magnetic circuit, the return path taking place through the bulk of the casting.

Permeability can be tested with this apparatus by any of the ordinary methods, the most simple, and one well adapted in connection with workshop practice, utilising a ballistic galvanometer. In this arrangement the magnetising coil of the plug is supplied with current from a battery through a regulating resistance, ammeter, and reversing switch. The search coil is connected to the ballistic galvanometer. On making, breaking, and reversing the switch, deflections are obtained on the galvanometer proportional to the magnetisation of the specimen. In order to make the instruments direct reading, the ammeter can be provided with a scale so that it indicates the values of H . In the same way a scale is provided for the ballistic galvanometer reading the values of B directly. The permeability is then obtained, if necessary, by dividing the value B by that of H , but in the ordinary commercial testing of castings, &c., it is generally sufficient to compare the values of B obtained with the curve of some known satisfactory specimen. It is often sufficient to know the value of the permeability for one value of the magnetising force. In this case the arrangement can be simplified by omitting the resistance and ammeter, and simply arranging for the cells to give one definite current. The divisions on the galvanometer can then be calibrated directly for values of permeability. Commercial forms of the apparatus comprise a wooden case containing a battery of two large dry cells, a reversing key, a plug connected by a long flexible conductor to that key and to

a d'Arsonval ballistic galvanometer marked directly in values of permeability. A space is provided for the plug and necessary drills.

In order to obtain a test the specimen is drilled, the plug inserted, and the key reversed. The pointer then directly indicates the value of the permeability, and if the circuit is then broken and the second reading taken, the value of the retentivity is given by subtracting twice the second reading from the first. In another commercial arrangement a milliammeter and resistance are included. Arrangements of this kind give accuracy within 1 to 2 per cent. They also enable the homogeneity of the casting to be determined from two points of view : (1) by inspection of the place drilled; (2) by comparison of the readings found after testing at different parts. There are very few castings or forgings in which a hole as described would not be admissible, but in the event of such drilling not being allowable a boss can be left on the casting in any convenient position for testing purposes. Care should be taken to have the bottom edge of the aperture in the plug quite sharp, so as to give certainty in the length of the pin used. The magnetising and search coils are wound on an insulated brass bobbin which is split to prevent eddy currents, and screwed to the end of the plug in such a manner as to allow of the yielding due to the slit, the ends of the coils being brought up through the plug. The gap between the search coil and the pin has some influence on the results, owing to the small size of the pin, because the coil cuts both the lines passing through the pin and those in the gap. This effect, though not large, can be allowed for by winding a few turns of wire in the magnetising and search coil circuits together round a bobbin. A reading is first taken by reversing the current without the iron core, then the deflection due to the space may be taken as approximately the square of the ratio of the differences between the diameters of the search coil and pin to that of the search coil, this ratio being multiplied by the deflection referred to above. By adjusting the number of turns in the compensating coil to give this deflection in the opposite direction, the effect of the gap is entirely eliminated.

In cases where a ballistic galvanometer cannot be used, a Wheatstone bridge arrangement is employed, two arms of the bridge including resistances and the other two respectively the magnetising coil and an Ayrton-Perry variable standard of self-induction. In place of the usual bridge battery a source of alternating current, such as a portable generator (or an interrupted battery current), is employed, a telephone being used instead of the ordinary galvanometer. The variable self-inductance is adjusted until no sound occurs in the telephone, showing that balance has been obtained, permeability being then directly read if the instrument has been previously calibrated for that purpose.

QUESTION No. 1,421.

Mr. J. E. Freeman writes us as follows :—"In your issue of December 31st, 1914, is an answer by V. F. Bush to Question No. 1,421, which asked for a method of finding out whether a concentric cable is carrying an alternating current or is 'dead.' Feeling somewhat sceptical as to the practical value of the answer, I have taken the trouble to construct the apparatus mentioned in the reply, and find, much to my surprise, that with a current of about 500 amperes on a lead-covered concentric cable the telephone receiver is absolutely silent. With a single conductor cable this method may be quite satisfactory, but it does not appear to me to answer the problem set by R. McC."

R. McC., who sent us the question, also writes to say that he has found, as stated in our editorial comment, that the search coil method is inconclusive and undependable, and he fears there is no real solution of the difficulty short of cutting the cable.

ANSWER TO CORRESPONDENT

"PUZZLED."—We do not think that it will be practicable to regulate your bus-bar pressure by means of a resistance in the way you suggest. It would be better to employ a regulating switch for varying the number of cells in circuit.

Birmingham and District Electric Club.—The annual report of the Club records an increase of membership, bringing the total to eighty. Six Papers have been read during the session, in addition to the annual dinner and summer visit. Mr. W. G. L. Riddle, formerly Hon. Sec. and now President, is temporarily absent in the Far East, and Mr. N. Deykin is now Hon. Sec. The annual subscription has been reduced from 6s. to 5s. The accounts show a satisfactory increase in the balance in hand.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 31st, 1914

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

24,871/13. **Variable Candle-power Lamp.** W. G. RHODES. The lamp is provided with two metal filaments of equal size, connected to three terminal plates in the cap, and a special switch is provided in the holder to place in circuit either one filament only, both in series, or both in parallel. (Two figures.)

28,409/13. **Wireless Telegraphy.** F. G. SARGENT. An A.B.C. or dial telegraph system, adapted to wireless working with synchronously revolving multiple contact makers at both ends. (Seven figures.)

28,413/13. **Wireless Telegraphy.** MARCONI'S WIRELESS TELEGRAPH CO., LTD., and H. J. ROUND. A receiving system using an oscillation valve detector consisting of a vacuum tube containing a hot filament, a cylindrical grid completely surrounding the filament, and a third cylindrical electrode completely surrounding the grid. The oscillating circuit is tuned to a frequency slightly different from that of the received wave, and is connected between the filament and the third terminal. The cylindrical form of the grid and third terminal prevents the glass becoming electrified by the cathode stream and producing polarisation effects, and the slight difference in tuning enables signals produced by continuous waves to be heard in the telephone. (Three figures.)

4,590/14. **Focus Lamp.** W. C. M. PETTINGILL. An incandescent lamp for motor-car headlights and other focus work with a special bulb, the spheroidal back surface of which forms a silvered concave reflector directing the light in a beam forwards. The front portion forms an annular reflector of different curvature which throws the light falling on it back on to the first reflector at a suitable angle, and the whole of the light passes out through the clear glass centre of the front of the bulb. (Three figures.)

11,920/14. **Pocket Lamp.** W. J. MELLERSH-JACKSON (*Inter-State Novelty Co., U.S.A.*). A pocket lamp in the form of a pistol with the trigger forming the switch. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, post free.

Summaries of some of the more important of these Patents will appear in our next issue.

Dynamos, Motors, and Transformers: WARNHOLZ, SPENCER, and WIGMORE [Reversible motors] 341/14; THOMPSON (*Aktiebolaget Jungströms Augturbin*) [Generators with rotary field magnets] 18,258/14.

Heating and Cooking: COOPER [Hot plates] 23,897/13; PATE and WOOD [Boiling plates] 11,996/14.

Ignition: GABELLI [Magneton] 9,104/14; STOCKDALE [Sparking plugs] 13,605/14.

CATALOGUES, PAMPHLETS, &c., RECEIVED

OSRAM LAMPS.—A new leaflet from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), giving prices of standard high- and low-voltage Osram lamps and such special types as special filament round bulb, "axial" and candle lamps, bears a striking reproduction in colour of the company's latest "Leading Light" poster. Another new leaflet deals with British-made Osram half-watt lamps in the 500- and 1,000-watt sizes of which large stocks are in hand. Both these lists can be overprinted with the names and addresses of contractors, dealers, ironmongers, &c.

SHAFT COUPLINGS.—A list from the British Thomson-Houston Co., Ltd. (Rugby), gives full particulars of standard lines of flexible flange couplings, solid flange couplings, and muff couplings. The flexible couplings are of the pin type, with leather washers clamped to the pins.

METAL-FILAMENT LAMPS.—A new series of four advertising cards published by the Edison & Swan United Electric Light Co., Ltd., illustrate, by effective sketches, the uses of the Royal Ediswan drawn-wire lamp in the hall, the dining-room, the kitchen, and the bedroom. These can be overprinted for any of the Company's customers.

Incandescent Lamps: BASTIAN [Manufacture of incandescent lamps] 28,935/13.

Instruments and Meters: BENTON [Indicating instruments] 3,587/14.

Switchgear, Fuses, and Fittings: PERRY [Conduit fittings] 28,854/13; HORTON [Switches] 5,360/14.

Telephony and Telegraphy: SUWA [Telephone systems] 25,720/13; PEDERSEN [High-frequency generators] 28,839/13; EASTERN TELEGRAPH CO., FRASER and WOOD [Perforators] 28,939/13.

Traction: W. R. SYKES INTERLOCKING SIGNAL CO. AND SYKES [Insulating rail joints] 29,260/13.

Miscellaneous: SOC. ANON. DES AUTOMOBILES & CYCLES PEUGEOT [Safety apparatus for lighting installations] 21,445/13. HOLT [Terminals] 28,746/13; WESTERN ELECTRIC CO. (*Woodward for W.E. Co., U.S.A.*) [Terminals] 557/13; VAN DER HOORN and WONDA [Electric safe apparatus] 10,898/14; HITZELBERGER and NEW BRITISH EVER READY CO. [Packing of cells] 17,597/14.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Ignition: KELLER-DORIAN [Magneton] 23,628/14.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

131/01. **Tumbler Switches.** A. P. LUNDBERG and G. C. LUNDBERG. This is a long specification with 28 figures describing a movable fulcrum system of tumbler switch construction which takes the strain off the springs both in the on and off positions. Details in the construction of the contact arm are also covered, and the combination of a wall plug with a switch of this type is claimed, as well as the use of a slotted nut for locking the cover.

409, 410 & 411/01. **Wireless Telegraphy.** G. MARCONI and MARCONI'S WIRELESS TELEGRAPH CO., LTD. The first of these is for the construction of a receiving transformer with primary and secondary in one winding, the centre turns forming the primary, and the end turns the secondary. The coil is divided into two parts by a condenser. The second specification covers the placing of a resonating system, consisting of a condenser and inductance in series, across the spark jet. The last is for inserting a condenser between the end of the antenna and the terminal of the sparking appliance.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: L. MANNSTAEDT [Conduits] 20,324/02.

Dynamos, Motors, and Transformers: A. M. TAYLOR [System of rectifying] 20,867/09.

Ignition: C. EBNER [Magneton] 19,501/08.

Switchgear, Fuses, and Fittings: F. BROADBENT [Solenoid starters] 20,369/06; B.T.-H. CO. and E. B. WEDMORE [Hand control and tripping gear for oil switches] 20,774/07.

Traction: A. OESTERREICHER and L. NEMELKA [Railway signalling] 19,996/03.

CALENDARS, &c.

The 1915 large sheet calendar of the British Thomson-Houston Co., Ltd. (Rugby), is a handsome production. Each sheet bears not only a large calendar of the current month, but has the useful addition of the preceding and following month on a smaller scale. Some interesting illustrations of plant supplied by the Company are reproduced.

W. T. Henley's Telegraph Works Co., Ltd., have sent us an office calendar with weekly tear-off sheets, decorated with a fine photogravure plate of the Tower of London.

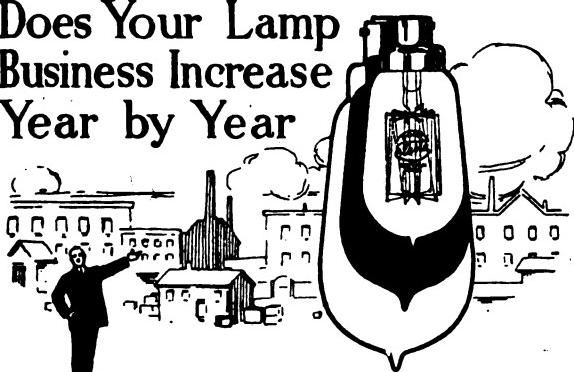
The 1915 calendar which Callender's Cable & Construction Co. are sending to their friends is a very artistic production. It bears a striking reproduction of a photograph of H.M.S. *Queen Mary*.

The Varley Magnet Co. (Woolwich) have kindly sent us one of their office calendars, which is of the large monthly sheet type executed in a harmonious colour scheme.

We have received a boldly printed monthly tear-off calendar from Nalder Bros. & Thompson, Ltd. (97A Dalston Lane, N.E.).

A very patriotic note is struck by the wall calendar of Gillespie & Beales (Amberley House, Norfolk Street, Strand), which is decorated with the flags of our principal Allies and excellent portraits of our King, President Poincaré, the Tsar, and the King of the Belgians, as well as Lord Kitchener, Sir John French, Admiral Jellicoe, and General Joffre. The firm offer to send copies to any of our readers, and the calendar is well worth applying for, if only for the excellent portraits.

Does Your Lamp
Business Increase
Year by Year



No?—Well, ensure
a successful 1915 by
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Sale of —————



Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden, London, N.W.
Telegrams: "Planetary, Kensal, London."
Telephone: Willesden 1170.

PATENT LOUD SPEAKING TELEPHONES

COMPLETE INSTALLATIONS FOR

WARSHIPS, MERCANTILE VESSELS,
MINES, POWER STATIONS, ETC.

Adopted by the British Admiralty, Foreign Governments,
the Leading Shipping Companies, and as used in many
Electrical Generating Stations.

ALFRED GRAHAM & CO.,
ELECTRICAL ENGINEERS AND CONTRACTORS,
ST. ANDREW'S WORKS, CROFTON PARK, LONDON.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Belfast.—The Corporation has at last decided to proceed with the extension scheme at an estimated cost of £28,390.

Bethnal Green.—The Electricity Committee has submitted an estimated cost of £15,944 in connection with the laying of cables and roadwork to deal with the bulk supply from Stepney.

Birmingham.—The Electricity Committee since October has received applications for 11,000 kw., and as the existing stations will be unable to carry this extra load after the present winter, it has been decided to proceed at once with the erection of a temporary generating station pending the completion of the new power station at Nethells. For this purpose a piece of land adjoining the refuse destructor at Nethells has been acquired in order not to interfere with the normal progress on the permanent station. The estimated cost of the temporary plant to be thus installed is £97,300, made up as follows:—Two turbo-alternator sets, including condensers, £38,200; six boilers and stokers without economisers, £25,000; temporary buildings, £4,000; foundations of boilers and turbines, £4,100; coal conveyor, £2,000; three feed pumps, £1,200; piping and valves, £2,500; switchgear, £2,200; generator cables, £600; five cooling towers and foundations, £12,500; sundries, £350; contingencies, £4,650. With the exception of the temporary buildings, all this expenditure is upon plant which will be transferred in due course to the permanent station later.

Darlington.—A scheme for the extension of the generating plant involving an expenditure of £20,000 has been adopted.

Hawarden.—A loan of £5,840 for an electrical installation has been applied for by the Rural District Council.

London: L.C.C.—Two 8,000-kw. turbo-generators with auto-transformers. Jan. 12th. (See advertisement on another page.)

Marylebone.—A sum of £5,524, which is required for additional plant, is to be borrowed from the revenue balance of the undertaking, in view of the fact that at present money cannot be borrowed in the open market at a lower rate of interest than 4½ per cent. It is estimated that a saving of £937 in interest will be made by this action.

Woolwich.—A loan of £32,935 is to be taken up to complete the works recommended by Sir John Snell.

Nottingham.—An expenditure of £20,000 on new mains is proposed.

Salford.—A loan of £18,252 is proposed for a transformer station in Greengate, and £25,000 for H.T. and L.T. mains during the next two years.

South Africa.—The Durban Council is issuing a loan of £350,000 five per cent. registered stock, repayable in 1929, for the purpose of extending the electric lighting, tramway, telephone, and other municipal services.

Tunbridge Wells.—Two water-tube boilers, economisers, mechanical stokers, feed heater, and cooling tower, &c. Borough Electrical Engineer. Jan. 26th.

Worcester.—A loan of £850 is to be taken up for services. The Council is recommended to adopt an all-electric drive for the pumping plant at the sewage works.

Wrexham.—700 yds. of cable are to be laid at an estimated cost of £300.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Ashton-under-Lyne.—School. Architects, Eaton, Son & Cantrall.

Brighton.—School, Loder Road.

Bristol.—Additional hospital accommodation (£7,700).

Eastbourne.—Premises for Prudential Assurance Co.

Eccles.—Bank premises for Williams, Deacon's Bank, Ltd., Manchester.

Hastings.—Fire station, Havelock Road.

London: Camberwell.—Herne Hill Sorting Office. H.M. Office of Works, Storey's Gate, S.W.

Manchester.—Public baths, Chorlton-cum-Hardy.

Newcastle.—Extensions to City hospital (£20,000).

Southampton.—School at Bishopstoke. Architect, L. Roberts, The Castle, Winchester.

Swansea.—Isolation hospital.

Miscellaneous

Australia.—The date for receiving tenders for thirty-four miles of paper-insulated, lead-covered cable, 7,720 yds. of submarine telephone cable, and 8½ knots of submarine telegraph cable has been extended by the Sydney Deputy Postmaster-General until January 15th. Copies of the specifications may be seen at 72 Victoria Street, S.W. This information, of course, is only of value to firms who can cable to agents.

Croydon.—Twelve months' supply of general stores for the Tramways Department. General Manager, Jan. 25th.

Dublin.—Twelve months' supply of electrical goods for the Dublin Port and Docks Board. Secretary, Jan. 13th.

London: Camberwell.—One or three years' supply of electric lamps. Town Clerk. Jan. 18th.

York.—Overhead material for 1½ miles of tramway. Engineer and Manager. Jan. 12th.

been resisted in most towns. At Brighouse the Electricity Committee has been told that unless current is supplied at a price not exceeding 2d. per unit, cinematograph theatres owners will put down their own plant.

East Ham: *Reduced Lighting.*—A suggestion by the Borough Electrical Engineer that arc lamps on hire should not be charged for during the period of enforced non-use in London, under the police regulations, has been adopted by the Electricity Committee on the understanding that these contracts are extended for a period equivalent to the period of enforced non-use.

Glasgow: *Feeder Breakdown.*—At 5 o'clock on Saturday a serious short-circuit occurred on one of the main feeders from the Port Dundas station, and there was in consequence a partial interruption of the supply for about a quarter of an hour.

Southgate: *The L.C.C. Power Bill.*—The *North Middlesex Chronicle*, referring to the copy of the Draft Bill relating to the supply of electricity in London which has been received from the London County Council, somewhat picturesquely states that the local Council received the proposal "with menacing growls and condemned it by implication."

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £60 15s. to £61 5s. (Last week, £60 10s. to £61.)

Canadian Agency.—A firm in Vancouver, B.C., desires to represent United Kingdom manufacturers of electrical goods. Further particulars at 73 Basinghall Street, E.C.

Liquidation.—Redglo, Ltd., is to be wound up voluntarily. Mr. E. J. Walker, 5 Castle Street, Liverpool, and Mr. P. Hutchison, 89 Chancery Lane, Ardwick, Manchester, are liquidators.

APPOINTMENTS AND PERSONAL NOTES

A station superintendent is to be appointed by the Maidenhead Electricity Committee at a commencing salary of £175 per annum.

Particulars are given in our advertisement columns of vacancies for temporary switchboard attendants, a shift engineer at Birmingham, a fitter-driver at Stafford, and a switchboard attendant for the Mersey Railway Co. A switchgear draughtsman and wireman are also required.

Mr. John Cowan, founder of the Stirling Boiler Co., has received a knighthood. Mr. E. G. Constantine has resigned his position as managing director of this Company, but remains on the Board. He is succeeded by Mr. H. J. S. Mackay.

LOCAL NOTES

Accrington: New Gas Plant.—The new gas-driven generating plant is now in operation, but the trial on the gas cleaning and sulphate plant has necessitated some minor alterations. The coal fuel cost of the new plant has been 0·273d. per unit, against 0·379d. per unit with the steam plant.

Brighouse: Supply to Cinemas.—In Brighouse, as in other parts of the country, a dispute has arisen between owners of cinematograph theatres and electric supply authorities as to the price at which current for use in the apparatus should be supplied. The general claim is that such current should be charged for at power rates, but this point of view has

Divisional Engineers—Royal Naval Division.—The Institution of Electrical Engineers is informed that it has been decided to form another Field Company of Engineers for the Royal Naval Division. It is desired that at least two sections of the new Company should consist of highly-trained men, and applications are accordingly invited from members of the Institution between the ages of nineteen and thirty-five. It is understood that the rates of pay and the duties are the same as those of the Royal Engineers. Applications should be addressed to Captain Harrison, Adjutant, Divisional Engineers, R.N.D., 2 The Downs, Dover Road, Walmer. It will be remembered that the Engineer Units of the Division consist largely of members of the Institutions of Civil, Electrical, and Mechanical Engineers. Nearly 100 of those who joined these Units since they were formed last September have received commissions in the Army.

The Future of London's Electricity Supply.—The Marylebone Electricity Committee has presented a long report in which it outlines the features of the London County Council's Electric Supply Bill, and concludes by recommending that a petition be deposited against it and also against the No. 2 Bill, in which it is proposed to incorporate a new power company for London. Important reports have been prepared upon the position generally by the General Manager of the Council's undertaking (Mr. A. H. Seabrook), and by the Council's Parliamentary Agents, but it is not proposed to circulate these reports at the present time. It is stated, however, that although conferences have been held with the Chairman and Vice-Chairman of the L.C.C. Electricity Committee and with Mr. C. H. Merz (the Council's consulting engineer), it has not yet been found possible to obtain the specific information required in order to answer the three questions which have been placed before the authorities concerned by the L.C.C., namely, as to whether the Council is in favour of the establishment of a more uniform supply of electricity; whether it is in favour of a central bulk supply undertaking; and whether it will support the L.C.C. Bill.

The Standing Conference of Metropolitan municipal electricity undertakings has passed a resolution against the L.C.C. scheme.

Lundberg's Electric-light Switching Competition.—We would remind those competitors who have not yet sent in their answer papers that the latest date for their receipt (except those from far countries) is Monday next, January 11th. Papers should be addressed to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., and not to Messrs. A. P. Lundberg & Sons direct. For far-off competitors the date is June 1st.

Obituary.—The death of Mr. J. F. Albright, which we regret to have to record, removes one of the pioneers of the electrical industry. Mr. Albright, who was in his fifty-seventh year, was closely connected with the early Edison and Swan Companies before the amalgamation into the present Edison & Swan United Electric Light Co., and, later, was on the board of Crompton & Co. He was afterwards managing director of the Drake & Gorham Electric Power Co., but his activities were by no means confined to these undertakings, as he was responsible for many other electric supply schemes, both at home and abroad. He was also interested in a large number of other companies.

The Enemy's Trade.—The seventh of the Exchange Meetings organised by the Commercial Intelligence Branch of the Board of Trade with the object of assisting British manufacturers to capture trade hitherto in the hands of Germany and Austria-Hungary will be held at 32 Cheapside, E.C., on Thursday and Friday, January 7th and 8th. This meeting will be devoted to the Electrical Accessories Trade. British manufacturers and representatives of wholesale houses who previously imported such goods from Germany and Austria-Hungary are invited to be present and to inspect the samples of German and Austro-Hungarian goods which will be on view.



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THE ELECTRICAL ENGINEER
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SUMMARY

SOME practical and useful notes in connection with house-wiring are given in a paper by C. J. Banister and C. R. Bates (p. 12).

A QUESTION has arisen as to the legality of charging for current for photo-printing at power rates. The Secretary of the I.M.E.A. holds strongly that it is allowable (p. 12).

AN interesting exhibition of German-made electrical goods was held under the auspices of the Board of Trade last week, to bring British manufacturers in touch with dealers who have previously bought these articles from Germany (p. 13).

WE give particulars of the law cases of electrical interest which are down for hearing during the Hilary Law Sittings which opened on Monday. An interesting appeal relates to the liability of consulting engineers (p. 13).

IN a paper read before the Society of Chemical Industry, Mr. E. Kilburn Scott described his experimental three-phase furnace for the production of nitrates from the air (p. 14).

THE causes of lack of balance in a compensator three-wire system are discussed in our "Questions and Answers" columns (p. 15).

AMONG the subjects of specifications published by the Patent Office last Thursday are an improved

system for generating continuous waves for wireless telegraphy, employing several arcs, by P. O. Pedersen. A tungsten filament lamp with fused silica bulb is also described by C. O. Bastian. Other specifications deal with conduit fittings and telephone working (p. 16).

WE give a description of a Marconi wireless station on the Straits of Magellan (p. 16).

ONE person was killed and a number rendered unconscious by smoke in an accident on one of the New York electric underground railways. The Board of Trade has intimated that it will not support the objection raised to the overhead trolley system on the L.C.C. trams in Stepney (p. 17).

OUR Trade Section contains illustrated articles on a new wiring conduit, an ironclad switch, indirect lighting fittings, a house service box, and a half-watt street lantern (pp. 17-19).

MAINS, services, motors, and transformers are required at York; generating plant at Limerick (£5,000); services and mains at Manchester (£20,000); a battery at Clacton; and electric lighting schemes are to be proceeded with at Waterford and Holmfirth (p. 19).

OWING to shortage of labour at Newport (Mon.) higher wages have had to be offered.—The Mayor of Doncaster, as Chairman of the local Tradesmen's Association, is strongly opposed to the municipal wiring clauses in the Corporation's Bill (p. 20).

Arrangements for the Week.—(To-day) Thursday, Jan. 14th.—Institution of Electrical Engineers. "The Shape of the Pressure Wave in Electrical Machinery," by Dr. S. P. Smith and R. S. H. Boulding, 8 p.m.

Monday, Jan. 18th.—Institution of P.O. Electrical Engineers, at I.E.E. Victoria Embankment. "Telephone Relays and their Application to Commercial Circuits," by C. Robinson, 6 p.m.

Institution of Electrical Engineers, Newcastle Section, at Mining Institute. "Automatic Protective Gear for Alternating Current Systems," by E. B. Wedmore, 7.30 p.m.

Junior Institution of Engineers, N.W. Section, 26 Corporation Street, Birmingham. "Country House Electric Lighting Installations," by C. F. Clifton, 7.45 p.m.

Tuesday, Jan. 19th.—Association of Supervising Electricians, St. Bride's Institute, Fleet Street, E.C. Informal discussion, 8 p.m.

Illuminating Engineering Society, at Royal Society of Arts. Discussion on "Some Points in Connection with the Scientific Development of Practical Applications of Searchlights," 8 p.m.

Thursday, Jan. 21st.—Greenock Electrical Society, 21 West Stewart Street, Greenock. "Electricity in a Shipbuilding Yard," by Duncan Angus, 7.45 p.m.

Saturday, Jan. 23rd.—Association of Mining Electrical Engineers, West of Scotland Branch, Royal Technical College, Glasgow. Joint meeting with National Association of Colliery Managers. "Electricity at the Coal Face," by John Bowman, 4.50 p.m.

SOME NOTES ON HOUSE-WIRING

A PRACTICAL Paper on "Wiring Systems" was read by Messrs. C. J. Banister and C. R. Bates before the Association of Supervising Electricians last month. In the introductory part of the Paper they allude to the fact that, in conduit wiring, faults are more prevalent than in casing work, and that the insulation test is more frequently low. Another advantage of casing is that, with good work, faults are practically unknown, and, owing to the absence of condensation, the life of the wires is longer. They point out, however, that to comply with the Wiring Rules of the Institution of Electrical Engineers, casing must only be used on the surface, and where some parts of the wiring have to be buried they recommend that one of the metal-covered cable systems should be used for these portions, rather than isolated lengths of steel, porcelain, or "compo" tubes. At points where the casing passes through floors they suggest that sheet-lead or zinc should be dressed round the casing to protect it from being wetted during floor-washing. The casing throughout the job should have ample thickness at the bottom, the centre fillet should be at least $\frac{1}{8}$ in. wide, and the capping should be at least $\frac{1}{8}$ in. thick, and should be fixed with screws or other fixings which will not rust or corrode.

In their remarks on conduit work, stress is placed on the importance of good enamelling of the tubes; the elastic and acid-proof enamel used by the better-class makers withstands the handling in erection much better than the cheaper japan used with inferior quality tubing. When moisture is present, galvanised or Sheradised tube is recommended—preferably the latter. For bending, a simple wooden bending block will give splendid results in the hands of a highly-skilled workman. There are, however, various bending machines in use, and the authors say that probably the best is the Kennedy bender, by which it is possible to form almost any bend, even with the light-gauge close-joint tube. The use of a bender ensures uniformity, and often effects a great saving in labour on a job.

No less than nine continuity devices for slip tubes are described in the Paper: (1) The pin grip system consists of a steel pin driven into a slot in the fitting, but the authors fear that there is too much risk of bad contact, as the enamel must be thoroughly removed both from the interior of the fitting and the outside of the tubing. If, after scraping the tube and fitting, a coating of metallic paint is added, they say that a fairly good connection is made which is reasonably permanent if carried out by a conscientious and skilful mechanic.

(2) The screwed grip nipple entails the use of a screwed fitting one size larger than the tube employed, with, therefore, less chance of the wires being damaged when drawing in. The use of a hexagonal head to the nipple is an advantage.

(3) In the Wallsall grip (quite recently referred to in our columns in connection with a patent action) the ends of the fitting are split, and the grip is obtained by a small pinching screw at each outlet. It is all in one piece, for the screw need never be removed; and the contact is good, as the machining of the interior surface is the last operation in manufacture, and the fittings are brush-enamelled, and not dipped. It is intended in future to make the fittings with a shallow thread which will cut into the enamel of the tube when the grip is tightened.

(4) The "Demon" grip has a screw which is turned after the tube is inserted, and the threads cut their way across the side of the tube.

(5) The "Grip-tite" is a split fitting with a saw-cut at the side of the lugs to give a better grip.

(6) The Credenda sleeve grip consists of a milled sleeve having a slight collar at one end; it has no screws, and need only be tapped home in the fitting (which need not be threaded).

(7) The "Perfecta" fittings have a small box at each outlet through which a set screw passes.

(8) In the Credenda spring grip a coiled steel spring fits over the tube and fitting; in turning the tube to get it home the enamel is scraped off.

(9) In the Eccentric continuity grip, just introduced, the fitting is bored eccentrically, as is also the nipple. The latter fits over the tube and inside the bore of the fitting, and by turning it the whole is tightened up and the contact surfaces cleaned by a rubbing contact. Neither the nipple nor the fitting are threaded.

For screwed conduit work the authors insert a draw-box at least every 25 ft. or 30 ft. on straight runs, and provide inspection fittings where there are two or more bends in

the tubing. Especially for damp situations the system with outlet or junction boxes throughout is preferred to one with the outlets at switches and crosses being made at a wooden block with some method of bonding the tube across it. Of late, the authors complain, the tendency has been to produce junction and inspection fittings with openings far too small to be of practical service. A description is given in the Paper of the latest forms of useful adjustable switch-boxes for use with sunk switches having covers flush with the walls. The ceiling rose box with terminals inside is preferred to the use of an ordinary box with fibre lid upon which the ceiling rose is mounted; and ceiling boxes with two or more back outlets are mentioned as being useful to make drawing-in easy when, for instance, the tubes run in the roof space of a new building. The new tube with screwed sockets (described on another page of this issue) was also mentioned.

When large cable is employed, e.g., 37/16, the authors point out that the usual types of inspection boxes and fittings are quite unsuitable for drawing in, and a split fitting only partly overcomes the difficulty, as it is not rigid when fixed. A large draw-in box with a plain normal bend is preferable to an inspection bend in this case. The best way out of the difficulty, in the authors' opinion, is to use armoured cable for these heavy cables instead of tubing. Architects are criticised for not affording sufficient provision for the electrical work, and it is pointed out that much cutting away and making good could be avoided by leaving channels in the floors communicating with vertical ducts in suitable positions. In this connection the revolutionary suggestion is made that such channels should be employed to carry bare copper conductors on insulators. As larger cables on medium-pressure systems, and all cables on high-voltage systems, are usually run on insulators and not in tubing, the authors think that the prejudice against wiring on insulators for low pressures is unreasonable.

The Paper then describes in detail the Kalkos, Stannos, Henley, and Cab Tyre wiring systems, and concludes with a consideration of the various types of fixings. Among these mention is made of the "Rawl" plug, a new plug consisting of a bundle of fibre strings laid together and stiffened with glue, to form a tube. The wood screw splits the fibres longitudinally and forces them against the walls of the hole, thus automatically forming a thread.

CHARGING FOR CURRENT FOR PHOTO-PRINTING

IN a recent issue of the *Municipal Journal* an inquiry from the Chairman of an Electricity Committee is published, asking whether it is illegal to supply current at power rate for photo-printing. That Journal agrees with the Town Clerk of the undertaking in question that such a practice is illegal, on the ground that the current is for lighting and not power. Mr. H. Faraday Procter, Hon. Sec. of the I.M.E.A., writes to us protesting emphatically against such a ruling. It must be remembered, writes Mr. Procter, that electrical undertakers do not sell either light, heat, or power. Their commodity is electrical energy, and when such energy is used for photo-printing it is not used as an illuminant, but for its actinic properties—a purely commercial use—and may certainly, therefore, be sold as power. If the argument held good that electricity used for photo-printing must be considered lighting and sold as such, then all luminous radiators would come under a similar ruling. The ultimate purpose for which energy is used must be taken into consideration in determining whether such use is lighting, power, or heating, and a moment's consideration will make this clear. In all electric lighting the energy is used primarily to heat the carbons or filaments in the lamps to such a temperature that they produce light, but would anyone suggest that all such energy must be sold at the heating rate, the natural corollary would be the abolition of all lighting rates.

Electric Lighting Provisional Orders.—Thirty-one applications have been made to the Board of Trade for electric lighting provisional orders, and these will come before Parliament in the usual manner next session. Of these, 20 are promoted by local authorities, seven by companies, and four by individuals. Competing orders are being promoted at Knaresborough by the Council and by the Harrogate Corporation, and in several other cases the orders are for extensions of area by existing supply authorities, including Tunbridge Wells, Warrington, Keighley, and Southampton.

WHERE THE GERMANS HAVE BEATEN US

Board of Trade Assistance

IMMEDIATELY after the outbreak of the war we published in our issue of August 13th a detailed statement with regard to Germany's electrical export trade, giving the quantities of electrical apparatus of the various classes which this country had bought from Germany in the preceding year. Our urgent appeal to manufacturers to take steps to derive the utmost benefit from the new field open to them has borne some fruit; but, especially in the smaller and lighter classes of electrical supplies, the purchases of which from Germany have been enormous in recent years, the manufacturers have for the most part been content to take matters slowly and to limit their activities chiefly to their standard products. It is no doubt excellent policy to educate the buying public to demand these, but more than this is needed if the trade in the cheaper grades of articles is not to return to Germany after the war is over.

The Board of Trade did useful work, therefore, in holding an exhibition in London, last Thursday and Friday, of electrical goods which have been bought largely from Germany in the past. Wholesale suppliers and large buyers were asked to send in samples of these with nett prices and other particulars; these samples were exhibited, and manufacturers were invited to inspect them. Any manufacturer who already made similar articles, or thought that he was in a position to do so, was invited to the inquiry office, where he was furnished with the name and address of the exhibiting wholesaler, and such other information as was available. Buyers and factors also visited the exhibition, and in some cases, we believe, orders were actually placed on the spot.

The number of articles was not great, and the whole exhibition was easily displayed in one room of fairly large dimensions; but, taken as a whole, the exhibits were fairly representative. The articles displayed to the greatest extent were switches, ceiling roses, lamp-holders, and similar accessories. Most of these had evidently been made for the British market, and, speaking generally, the porcelain bases and covers were of poor glaze and finish, but the metal-work was not by any means of such bad finish that a British manufacturer need be ashamed to imitate it for his second-grade products. There were some exceptions, of course; but these had mostly been selected by exhibitors to show in what respects some of the cheapest German goods were inferior. The prices were certainly low, sometimes almost absurdly low; but it must be remembered that the prices were those for which the articles were bought before the war, and both now and afterwards buyers will be prepared to pay higher figures. Thus there were bridge-type ceiling roses, quite good except for the finish of the porcelain, priced at 18s. a gross. We were informed by a porcelain manufacturer that the reason that the cost of these is so low in Germany is not that the machines are more efficient or their output more rapid, but simply that the workers and apprentices were paid much lower wages, while the freight of China clay from Cornwall was no greater to Germany than to the Midlands. Tumbler switches, some priced as low as 7s. 5d. per dozen, were of qualities for which the Germans have certainly found a good market in this country. Some all-porcelain switches of the Continental pattern with grooves in the bases for side entry of the wires, and also lamp-holders with "Edison" sockets, proved that these had been frequently bought here in quantities for re-export to the Colonies and abroad. There were lamp-holders, some fairly good and others very bad; key lamp-holders complete with cord grips had been bought at 6s. to 7s. per dozen, and we were informed by the representative of one large British manufacturer that he could certainly turn out a good second-grade quality at prices approaching to this. Wood blocks were also exhibited; surely it should have been unnecessary to buy these abroad.

The bell-pushes were certainly cheap and nasty; some porcelain pushes were actually marked at 15s. 8d. per hundred, and wooden ones from 6s. 10d. per gross. As for the bells themselves, their most noticeable characteristics, besides cheapness, were the extremely good external polish and finish of the common deal bases and covers, and the abominable nickel-plating of the gongs. A few bell indicators were shown, low-priced and with bad woodwork.

The British Post Office had sent some German telephones and miscellaneous ebonite parts, and also two cards of glass caps for exchange indicator lamps. A case contained Crookes tubes, vacuum tubes, and chemical glass-ware, of

which a large proportion has always come from Germany. Needless to say, there were glass and enamelled iron shades, and also hoods for lanterns, arc-lamp carbons, and insulated cables and wires. A pair of rubber gloves, somewhat the worse for having been in stock for some time, lay neglected in a corner. Meters of well-known German makes were on view, and a collection of small motors and fans, a few electric irons, and immersion heaters. A number of extremely cheap toy motors attracted much attention; apparently there is a market for these, but British manufacturers, probably rightly, have not thought it worth their while to turn their attention to them. On the other hand, a tiny "shocking" magneto was on view, which, although an imitation of a German make, had, we were told, been made by a British manufacturer and sent in error—a mistake which, we understand, proved profitable to the maker. A few, but by no means representative, specimens of useful electro-medical apparatus had been sent, and it is to be hoped that such things will soon be made in larger quantities here. It is, for instance, practically impossible now to obtain such necessary apparatus as cystoscopes, as these have been a German speciality.

We trust that this small exhibition will have done some good, but both from the number of exhibitors and the number of manufacturers who visited it, it is evident that it has merely opened the way, and that it rests with our electrical manufacturers themselves to take further action. It is obvious that many dealers who have hitherto bought their cheaper lines largely from Germany do not care to make this too widely known, and although the Board of Trade scheme was a good one, its value should chiefly be in the stimulus it may give to manufacturers themselves. They must know intimately the patterns, qualities, and prices of the German goods which have been bought instead of theirs, and now that trade is a little more settled they should be able to gauge the demand as well. They should now take the initiative, and advertise at once (preferably with prices) the equivalent articles which they already manufacture, and they should advertise also for inquiries for those which they have hitherto not thought it worth while to produce. The field should be particularly good in smaller fittings and accessories; there are many makers of these who are none too busy at present, and the difficulty of obtaining porcelain, although a real one, is not insuperable—at a pinch it must not be forgotten that another material can be used as a substitute, or they might even learn how to make the small special porcelain parts themselves if the porcelain manufacturers cannot meet the emergency.

PENDING ELECTRICAL LAWSUITS

DURING the Hilary Law Sittings, which commenced on Monday, the Walsall Hardware Co. will appeal against the judgment of Mr. Justice Joyce, who held that the split grip conduit fittings made by the Stella Conduit Co. are not an infringement of their patents. The action was reported in ELECTRICAL ENGINEERING of Oct. 27th, p. 560, and Nov. 19th, p. 598. Another appeal of interest is by Messrs. Kirkland and Capper and J. H. T. Wood, in regard to the liability of consulting electrical engineers. The action in question concerned the wiring of the Medical Staff College and Laboratories at Millbank for the War Office, and was dealt with in our issues of April 23rd, p. 224, and May 14th, p. 267, 1914. There is also to be an appeal on a preliminary point in the B.T.-H. v. Duram metal-filament patent case; the case itself will not come on until after Easter.

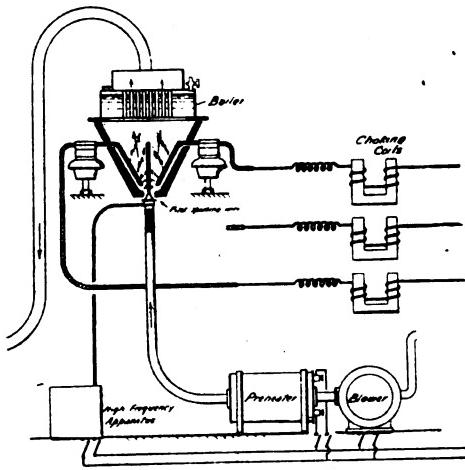
In the Chancery Division the metal-filament patent infringement actions by the Osram Lamp Works, Ltd., against Pope's Electric Lamp Works, Ltd., and the Corona Lamp Works, Ltd. (of which particulars were given on p. 545 of our issue of Oct. 15th, 1914), are down for hearing before Mr. Justice Eve and Mr. Justice Warrington respectively, instead of as originally allocated before Mr. Justice Joyce and Mr. Justice Sargent. Similarly, the application for a compulsory licence under the drawn-wire metal-filament lamp patents by the Robin Electric Lamp Co., dealt with in detail in our issue mentioned above, is transferred from Mr. Justice Sargent to Mr. Justice Warrington. Early on Mr. Justice Sargent's list is the Ilford preferential charging action. The dispute between the Beck and Foster Engineering Companies over the carbons which formed the subject of police court proceedings in September is now transferred to Mr. Justice Eve in the Chancery Division.

ELECTRICAL PRODUCTION OF NITRATES

A meeting of the Society of Chemical Industry, held on Jan. 4th at the Northampton Polytechnic Institute, Mr. E. Kilburn Scott read a Paper on the Production of Nitrates from Air, illustrated by experiments. The subject was one of considerable importance in view of the fact that nitric acid was used extensively in the manufacture of explosives both for mining and war purposes. It was notable that the Germans were to some extent independent of imported nitrates in this respect, on account of the electrical nitrate factories of the Badische Anilin & Soda Fabrik. There was also another large factory in Norway which was, however chiefly controlled by Scandinavian and French interests.

All nitrogen fixation furnaces have electrodes of metal between which alternating-current arcs are formed. These arcs are "blown" into flames by a magnetic field or an air blast, and provision is made for the passage of large quantities of air through these flames. Owing to the great heat of the electric arc, and possibly also to electronisation, some of the air is acted upon and the nitrogen and oxygen combine to form nitric oxide. As this gas dissociates unless it is immediately cooled, it is necessary to provide a cooling zone in close proximity to the flames and arrange for the gas to enter that as quickly as possible.

Mr. Kilburn Scott proceeded to describe the Birkeland and Eyde furnace (see ELECTRICAL ENGINEERING, Vol. V., p. 515, June 3rd, 1909), of which thirty-two of from 600 to 1,000 kw. each are in use at Notodden and eight of 3,500 kw. at Saaheim, in Norway. In this furnace a single-phase arc is flowed outwards in a disc-shaped chamber by the action of a very powerful magnet energised by continuous current, so



EXPERIMENTAL NITROGEN FURNACE.

that a circular sheet of flame is produced through which the air is passed by suitable channels. The tube furnace of Schönherr and Hessberger (also described in the article referred to) is used at the Christiansand works of the Badische Anilin & Soda Fabrik, and also at Saaheim. In this a single-phase arc is blown up a tube by a whirling current of air introduced through tangential orifices. Although simpler than the Birkeland and Eyde furnace in that it employs only one kind of current, it cannot be built in such large sizes on account of the excessive length of tube required, which for 1,000 kw. is already 20 ft. long.

The Pauling furnace used at nitric acid factories at Gelsenkirchen, Innsbruck, and Milan, also at Roche de Rame, France, and in South Carolina, U.S.A., is built on the lines of a horn-type arrester—that is to say, it has two electrodes which diverge so as to give a fan-shaped space between them. It differs from a lightning or surge arrester, however, in having an air blast which has the effect of filling the fan-shaped space with flame. The electrodes are set several inches apart to allow the air supply to pass through, and from each electrode there projects a starting or kindling knife of thin copper set on edge so as to obstruct the air as little as possible. These kindling knives are approached to within about 3 millimetres of each other, and as they burn away are fed forward by a rack behind. The kindling knife passes through the bottom horizontal bar of the main electrode.

The author on the whole prefers the air-blown arc furnace of the Pauling type, but this, in common with the others described, suffers from the disadvantage of being unable to work with three-phase current. His own furnace, which has been developed on a laboratory scale at the Northampton

Polytechnic, employs three-phase current at 2,000 volts 25 cycles.

The three electrodes of the furnace are attached to double petticoat porcelain insulators spaced 120° apart. They are of steel rod $\frac{1}{4}$ -in. diameter, and the inclined sides are bent at about 30° from the vertical line. The rods pass through holes drilled in a standard fireclay crucible which serves as the wall of the furnace. The bottom of the crucible is also drilled through, and immediately beneath is the air-supply pipe. The upper portion of the pipe is made of insulation material and a No. 18 gauge iron wire is attached to the nozzle so as to project vertically upwards with its point midway between the three electrodes and just below them. This wire is for the pilot sparks, and it is connected to a high-frequency, high-voltage apparatus somewhat similar to apparatus used in wireless working, which produces a stream of high-tension sparks from the wire to the electrodes which break down the air, and the main three-phase current can then follow. The bottom ends of the main electrodes are set about $\frac{1}{4}$ in. apart, so as to allow the air to pass freely, and they do not require any adjustment because the pilot sparks always make a path for the main current to get across. The essential parts of the experimental furnace are indicated in the figure.

Air is supplied by a motor-driven blower through a pre-heater, and the top of the apparatus forms a boiler which cools the gases and enables some of the waste heat to be recovered. Designs were shown for a full-sized commercial furnace with water-cooled electrodes, and the method of working proposed includes using the steam from the boiler in a mixed-pressure turbine, whereby a gain of 15 per cent. in economy is expected, and the enrichment of the air by addition of oxygen before it passes to the furnace. After passing through all the absorption system the oxygenated air would not be allowed to escape into the atmosphere, but would be brought back to the furnace. If it were allowed to escape there would, of course, be great waste of oxygen, but by working in a closed cycle only make-up oxygen would be required, and therefore a small oxygen plant would do. The ideal condition, says the author, would be obtained by linking-up the nitric acid factory with an industrial process which gives off oxygen as a by-product. There are several such industries. The first is the manufacture of hydrogen for aircraft, the second the manufacture of calcium cyanamide. A third is one method of manufacturing sodium cyanide, and a fourth is the manufacture of hydrogen for increasing the density of oils for margarine, &c.

The arrangements proposed for dealing with the product and for making ammonium nitrate from it are detailed in the Paper. The average yield of existing furnaces is given as half a ton of 96 per cent. pure nitric acid per kw.-year, and Mr. Scott expects an additional gain of 15 per cent. due to recovery of waste heat by the boiler, a further gain of 20 per cent. in economy by working with oxygenated air on a closed cycle, and looks forward to a gain of as much as 30 per cent. due to the higher temperature attained in his form of three-phase arc.

Foreign Motor Dictionaries for the Front.—The Commercial Motor Users Association has presented to the British Red Cross Society, the French Red Cross Society, the Army Service Corps, the Royal Naval Division, and the Recruiting Authorities, several thousand copies of a handy pocket motor dictionary, printed in English, French, and German, for the use of the motor transport drivers on active service on the Continent. The booklet, which is of a size suitable for the waistcoat pocket, comprises twelve pages, and contains 500 words referring to the construction and running of a motor vehicle. There are still a few copies of the dictionary available, and anyone interested may obtain a copy by forwarding a 1d. stamp to cover postage, to Mr. F. G. Bristow, Secretary, The Commercial Motor Users' Association (Inc.), 83 Pall Mall, London, S.W.

The Belgian Chamber of Commerce.—The Belgian Chamber of Commerce in London (Incorporated), appeals to the British manufacturers and merchants for support. It has rendered valuable services since 1890 to industries and commerce between the two countries, and since the beginning of the war its task has become much more arduous. After the cessation of hostilities it will have important duties to perform in helping the commerce of the two countries by bringing together manufacturers and buyers of goods, and in other ways. Difficulties are found in carrying out these duties through lack of funds, as Belgian supporters are unable now to send their usual remittances. Applications for membership and contributions to be sent to the General Secretary: Mr. P. Dorchy, 24 St. Dunstan's Buildings, St. Dunstan's Hill, E.C.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

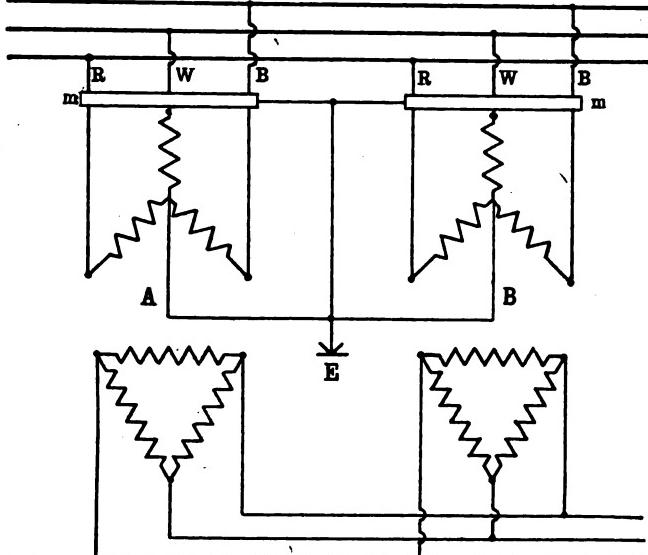
RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,425.

A number of three-phase, 25-cycle induction motors are connected to three bus-bars supplied from two 200 k.v.a. transformers at 400 volts between phases. Each transformer is provided with a four-wire watt-hour meter, the two potential coils in each case being connected between two of the phase wires,



A.B. TRANSFORMERS. M.M. WATT-HOUR METERS.

and the neutral point of the system, which is earthed. It was desired to check the relative loading of the transformers by simultaneous readings. The only instruments available were two indicating watt-meters, and these were inserted in turn in the phase wires, as shown in the figure. The results obtained were as follows:—

| Trans-former. | Current Coil in Phase. | Potential Coil between Phases. | Watt-meter between Neutral and Phase. | | Watt-meter Reading. |
|---------------|------------------------|--------------------------------|---------------------------------------|---------------------|---------------------|
| | | | Reading. | Watt-meter Reading. | |
| A | R | R-W | 140' | R | 25 |
| B | R | R-W | 55 | R | 80 |
| A | W | W-R | 180 | W | 80 |
| B | W | W-R | 185 | W | 90 |
| A | B | B-W | 130 | B | 110 |
| B | B | B-W | 200 | B | 85 |

It should be noted that while each pair of readings was taken simultaneously, the observations of one phase are not comparable with those of another as the load may have altered meanwhile. What is the explanation of the wide variation in the relative values of the simultaneous indications which were obtained?—J. E. F.

(Answers must be received not later than first post Thursday, Jan. 21st.)

ANSWERS TO No. 1,423.

In each of two four-pole direct current generators, fitted with four interpoles and three slip-rings for connecting to a three-phase static balancer, the voltage on the two sides of the system differs by about 3 per cent. when the load is balanced (as current in the middle wire), and the brushes are in the neutral position. The series and commutating pole windings are connected one-half on each side of the armature, and the drop of volts across each set is the same. The voltage between each pair of slip-rings is equal.

Explain the cause of the unbalanced voltage, and suggest remedy.—KoIL

The first award (10s.) is made to "M. M.," whose reply is given in slightly abbreviated form below:—

It is evident that the difference in voltage must be due to want of symmetry in some part of the plant. As there is no current flowing in the middle wire, there will be no difference of potential in that wire between the load and the point of connection to the choker. Therefore, with a difference of voltage between the two sides it would appear that the "neutral" point of the choker is not at the mean potential. Although there is no current flowing in the neutral wire there may be an appreciable current circulating in the mesh-connected armature winding by way of the slip rings and the choking coil. These circulating currents may so upset the equilibrium as to cause the noted difference of voltage. Altering the points of connection to the armature winding might improve matters, but would be rather difficult. Again, if the armature coils are unsymmetrically placed it would be almost impossible to re-arrange them. Any want of symmetry should be evident by taking voltages between the slip rings when machine was unloaded. Perhaps the simplest method would be to arrange the load with a certain out of balance in order to help matters, but this would not be a very scientific procedure. If the trouble is due to shape or strengths of pole-pieces, alteration would be a serious matter. The fact that both machines give a similar result leads one to suppose that the fault is due to construction or rather design. Note whether the armatures are concentric with the poles, if not, this can be remedied. If they are concentric, improvement might be effected by setting one armature slightly eccentric by packing up the bearings. To find out whether the trouble is due to excessive circulating currents a machine could be run for definite times with and without the choker in circuit; other things being equal. An idea of the value of any circulating currents could then be obtained by finding temperature of the armature windings.

The second award (5s.) is made to "E. P. H.," whose reply is given below in abbreviated form:—

The source of trouble is probably some difference in reactance between the two sets of balancing transformers. It is in practice found not to be wise to run these in parallel unless the plant is under careful supervision, and for the majority of cases one transformer will meet the usual out-of-balance load. If the trouble occurs only when both sets are in parallel, then the trouble is in transformers as above or is due to the frequency, i.e., the speed of the two sets not being identical. The condition of the slip-rings should be noticed, as, if some rings are out of truth, a large voltage-drop may occur here.

There is again (in the case of new plant) the possibility of tappings being made incorrectly in armature, or not identical tappings in the two machines. The mid-wire ammeter upon which the out-of-balance load has been read being a centre zero meter, it would be well to see that this has not a bent pointer. The temporary inserting of an ammeter (*AC*) in the balancing transformer mains to check the balance would throw some light on the trouble.

ANSWERS TO CORRESPONDENTS

F. J. H.—The active material of box-type negative battery plates is usually made from pellets containing litharge mixed with some expanding material, such as lampblack dropped into place in the openings in the plate, and covered with sheets of perforated lead. You will find further information on this subject in "Storage Batteries," by H. W. Morse, a copy of which we can supply you with for 6s. 10d., post free.

L.G.—The relative merits of geared turbo-generators, and turbo-alternators used with rotary converters for giving D.C. supply where the size of unit renders direct-coupled D.C. turbo-generators unsatisfactory, depends upon conditions varying in each case. The matter was referred to in ELECTRICAL ENGINEERING, May 21st, 1914, page 227, and June 11th, page 523.

C. G.—The number of cycles per second of the magnetisation of the iron in any limb of a polyphase transformer is the same as the frequency of the supply. However many phases the generator is wound to give, the frequency in each phase is the same as if the generator were wound for single phase, although the maxima in each phase occur successively during each cycle.

H. TAYLOR.—As you will know upon which circuit the "short" is by the blown fuse on the distribution board, divide the circuit at one of the fittings and switches where the wires are looped-in, and test with a bell and battery to see on which side the short is. Go on dividing up in this way until the short is found.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 7th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

25,720/13. **Telephony.** M. SUWA. A telephone system comprising a circuit wherein the batteries are included in independent transmitter circuits, each connected to the main line through a transformer when the receiver is removed, but are included in the main line circuit and rendered inoperative by the potential balance of the batteries when the receivers are on their hooks. (Three figures.)

28,839/13. **Wireless Telegraphy.** P. O. PEDERSEN. Improvements in the Poulsen arc system of continuous wave production, wherein several arcs which become active in succession are inserted in series or in parallel in the oscillation circuit, each single arc being passed by current impulses, corresponding to one or some few oscillations at a time, practically no current passing during the time the other arcs are in action. (Ten figures.)

28,854/13. **Conduit Fittings.** R. W. PERRY. The fittings are provided with bosses to receive screw pins, clamping and making contact with the tubes, and the edges of the hole are turned over inwards to engage loosely a threadless portion of the screw pin to prevent its detachment. (Three figures.)

28,835/13. **Incandescent Lamps.** C. O. BASTIAN. Lamps with tightly coiled helical tungsten wire filaments sealed by tungsten leading-in wires into fused silica bulbs. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: McGEOCH [Casing] 8,062/14.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. Co. (G.E. Co., U.S.A.) [Transformer Regulators] 29,063/13; DE LA RIBOISIÈRE and LE GRAIN [Motors for sliding windows] 29,562/13; MASON [Generators] 29,655/13; B.T.-H. Co. and POLLOCK [Dynamos] 124/14.

Electrometallurgy and Electrochemistry: HARBECK and LÄN [Electrolytic production of iron] 1,437/15.

Heating and Cooking: GAUNTLETT [Electric heating device] 2,325/14.

Ignition: CELERI [Electric igniters] 11,624/14; MASON [Magnets] 21,583, 21,610, 27,743, and 21,996/14.

Switchgear, Fuses and Fittings: B.T.-H. Co. (G.E. Co., U.S.A.) [Globe holders] 125/14 and [Voltage regulators] 5,776/14.

Telephony and Telegraphy: MARKS (Mead Electric Signal Co.) [Signalling apparatus] 25,062/13; PEDERSEN and POULSEN

[Multiple arrangement of high-frequency generators] 26,834/13; BROWN and PARSONS [Signalling system] 28,956/13; SYKES and FORD [Production of oscillations] 29,902/13; MARR [Pole pieces of telephone receivers] 1,715/14; WESTERN ELECTRIC Co. (Woodward for W.E. Co., U.S.A.) [Printing telegraphs] 9,376/14.

Traction: HUTCHES [Automatic control of electric railways] 28,703/13.

Miscellaneous: JOBKE [Magnetic separators] 26,364/13; CLARKE [Advertisement device] 29,516/13; MCKAY and CLAUSSEN [Portable lamps] 2,495/14; WILSON [Electric chiming gear] 4,261/14; BURBRIDGE and ALDERMAN [Device for taking down and putting up lamps] 13,707/14; LYNCH WOCHNER and SAUERMANN [Magnetising permanent magnets] 19,517/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Meters: LANDIS & GYR [Prepayment] 24,013/14.

Telegraphy: ARMSTRONG [Receiver for continuous waves] 24,231/14.

Miscellaneous: CLENET and ANR [Ringing relays] 23,563/14; Soc. ANON. DES AUTOMOBILES ET CYCLES PEUGEOT [Safety apparatus for electric light installations] 23,813/14.

The following Amended Specification can now be obtained:—
Electric Furnaces: C. A. KELLER, 20,371/13.

Amendment Made

29,351/12. **Automatic Telephone Manufacturing Co., Ltd.** (Automatic Electric Co., Ltd., U.S.A.) This specification, which describes a method of automatic telephone working with main and sub-exchanges, has been amended by way of disclaimer.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. Co. (G.E.C., U.S.A.) Insulating material, 19,035/05.

Dynamos, Motors and Transformers: A.E.G. [Compensating windings for turbo-generators] 20,808/06; SIEMENS BROTHERS DYNAMO WORKS and E. O. KIEFFER [Ventilated commutator] 19,891/08.

Instruments and Meters: G. HOOKHAM [Mercury watt-hour meters] 20,219/04.

Batteries: G. A. WEDEKIND [Copper oxide electrodes for alkaline primary batteries] 20,313/03; H. P. R. L. PÖASCKE [Dry cells with feric chloride depolariser retained by gum] 21,348/06.

Switchgear, Fuses and Fittings: B. T.-H. Co. [Controlling switch for watertight doors] 21,253/06; D. ASSERSONN [Holder for tubular lamp] 21,197/07.

Telephony and Telegraphy: W. JUDD, A. FRASER and R. HARDIE [Automatic transmitter] 19,099/05; E. BLOS [Automatic telephone exchange selector switch] 21,752/09.

Miscellaneous: L. S. ROLLAND [Electric welding machine] 19,116/05.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The *Wireless World* contains a description of a powerful wireless station recently opened by the Marconi Co. for the Chilean Government at Punta Arenas on the wild coast of Patagonia in the Straits of Magellan, which is said to be the most southerly town in the world. The station is housed in a ferro-concrete building some three miles from the town, and contains a 100-kw. equipment for long-distance communication and a 5-kw. set for ship traffic, &c. Four distinct aerials are used—two for radiating different lengths of 100-kw. waves, one for reception of long waves, and the fourth for the 5-kw. set. All are of the inverted L directive type, and are supported on pulley blocks slung from porcelain insulators on 250-ft. steel masts, so that an adjustable sag is allowed to prevent undue strain in heavy gales. Provision is made for passing current through the aerial wires to thaw them if covered with a dangerously heavy load of ice. The

large generating plant is driven by a 270-h.p. Diesel engine, and develops 140 kw. at 200 to 360 volts continuous-current; a 2,000-ampere-hour battery is also provided. The transmitting apparatus includes a condenser of 1.25 mf., made up of 416 "Poldhu" pattern pots of a new design charged at 10,000 volts, and a 38-in. radial disc discharger in a sound-proof chamber. Either 5,000 or 3,000 metre waves can be sent. Both crystal and valve type receivers are used for the long waves, and a magnetic detector and a spark recorder is used in connection with the 5-kw. set. Hand as well as automatic transmission by perforated strips is provided for. The large set is used principally for communication with Puerto Mouth on the Chilean coast, some 850 miles to the north.

A Ramsgate man named Richard Softley has been fined £15 for having in his possession a wireless telegraph apparatus which the Post Office officials stated at the police court prosecution could have been fitted up in three or four hours to receive messages from Germany or any high power station within a 1,000-mile radius. The defence was that the parts were used to teach Boy Scouts.

Telegrams for Mollendo and district are no longer subject to delay.—The cable between Paramaribo and Cayenne has been repaired.

ELECTRIC TRACTION NOTES

A serious short-circuit occurred on Jan. 6th in one of the underground electric railways in New York on one of the feeder cables, and the smoke produced caused a panic and rendered a considerable number of passengers unconscious in the over-crowded trains. The traffic was brought to a standstill for some time, and the work of rescue was attended with great difficulty. In all some 300 persons are reported injured, and there was one death. It is stated that the issue of tickets was not stopped immediately, and further passengers continued to crowd into the stations. From some accounts it would appear that a further fire was caused by attempts to re-establish the supply. Officials of the London Electric Railways state that such an occurrence could not be attended with such serious results on the London Tube Railways, owing to the better ventilation, the more complete arrangements for emergency lighting, and the

better organisation for conducting the passengers away. More complete information as to the nature of the fire will be awaited with interest. From telegrams so far to hand it is not clear whether any of the rolling-stock caught fire.

The dispute between the Stepney Borough Council and the London County Council as to the electrification of the horse tramways in that Borough, which was the cause of the experiments with the surface-contact system in the Mile End Road, is again engaging serious attention. The L.C.C. is proposing to equip the tramways in Grove Road and Burdett Road upon the overhead system, and the Hackney and Bethnal Green Councils, in whose districts the lines also run, have agreed. Stepney, however, has hitherto refused to agree to anything but the conduit system, and the Board of Trade has intimated to the Stepney Council that it will not be prepared to withhold its consent to the reconstruction on the overhead system, on the mere ground that the L.C.C. will not adopt the conduit system.

There is a probability of the Mumbles Railway being converted to electric traction at an early date. This steam line is the second oldest in the United Kingdom, and is worked by the Swansea Improvements and Tramways Co.

"ELECTRICAL ENGINEERING" TRADE SECTION

CATALOGUES, PAMPHLETS, &c., RECEIVED

LANTERN SLIDES.—Siemens Bros. Dynamo Works, Ltd. (Caxton House, Westminster), have issued a revised catalogue of the technical lantern slides which they keep in stock and are ready to lend to lecturers, schools, &c. The list has been considerably extended, and contains 208 different views of all classes of electrical machinery and apparatus manufactured at the Stafford and Dalston works.

WASTE HEAT BOILERS.—A pamphlet from the Bonecourt Waste Heat Boiler Co., Ltd. (Parliament Mansions, Victoria Street, S.W.), gives particulars of a series of furnaceless boiler for utilising the waste heat of the exhaust gases of internal combustion engines or industrial furnaces, without additional cost of fuel. Another form is a combined waste heat and fuel-fired boiler utilising the Bonecourt system of surface combustion.

ELECTRIC COOKING.—A new list of electric cooking apparatus issued by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), deals with a very complete range of appliances, and includes many designs of kettles, irons, hot plates, toasters, &c. Electric ovens of four distinct types are illustrated, and electric urns, large and small water-heaters, hot cupboards and the larger class of electricity heated appliances are also listed.

ELECTRICAL SUPPLIES.—The Edison & Swan United Electric Light Co., Ltd., have brought out a new and effective "poster stamp," bearing the words, "Ediswan Everything Electrical.—The Symbol of Electric Service."

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

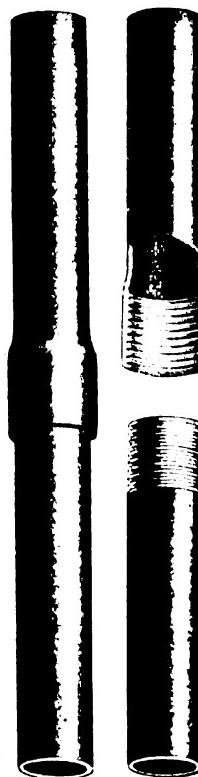
FITTINGS FOR HALF-WATT LAMPS.—The Sun Electrical Co., Ltd. (118 and 120 Charing Cross Road, W.C.), send us a new list of their own registered designs of British-made fittings for half-watt lamps, in which the various points that require attention when dealing with light sources of high intrinsic brilliancy, have been specially attended to.

HEATING AND COOKING APPARATUS.—Another new list from the Sun Co. deals with electric cooking apparatus, &c., of handsome design for use on the table. These are of high finish as well as reliable electrical quality.

IRONCLAD SWITCHGEAR.—J. H. Holmes & Co. (Newcastle-on-Tyne) have recently developed an interesting system of ironclad switchgear of the draw-out type, specially suitable to mining and sub-station work. This is now fully standardised, and prices and particulars of switch pillars on this system are contained in a leaflet which engineers will find interesting to consult.

INTERCOMMUNICATION TELEPHONES.—A folder from Electrical Installations, Ltd. (27-28 Martin's Lane, Cannon Street, E.C.), calls attention in an effective way to the advantages of the system of intercommunication telephones, which they are prepared to install and maintain.

A NEW WIRED CONDUIT.

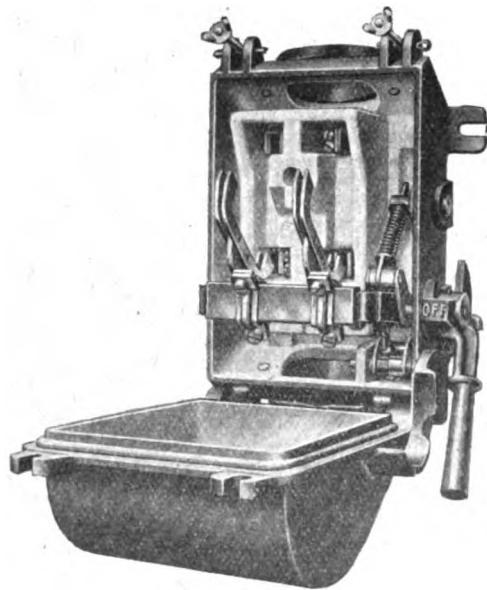


WE illustrate here a new wiring conduit recently introduced by the Perfecta Seamless Steel Tube & Conduit Co., Ltd. (Plume Street, Birmingham). It is seen that instead of couplings being employed to join up lengths of tube, the tube is bulged at one end and tapped with a tapered female thread, the other end being a standard parallel male thread. The appearance is, of course, much neater than with a conduit, and for surface work in hospitals and other public buildings the system has the additional great advantage of giving less surface for dust collection. For concealed work there is less depth of cutting away required, as there are practically no sockets or couplings to account for. It is claimed that, owing to the cutting action of the parallel thread when screwed home, the joint is absolutely watertight, and this cutting action naturally ensures perfect electrical continuity. An incidental advantage is that the length of the thread is less. For outside work, the bulged end of the tube is, of course, placed uppermost, so that water does not collect at the joint, as in the case of a coupling joint. The tube is supplied both in the seamless and welded qualities.

A NEW IRONCLAD SWITCH

A COMPACT design of ironclad water-tight switch with several interesting features has been introduced by J. H. Tucker & Co. (King's Road, Hay Mills, Birmingham) possessing several interesting features. The figure gives a good idea of its construction. Both the make and the break are rapid, independently of the rate of movement of the handle, and they are satisfactorily locked when in the on position. The actual break is a positive mechanical action, the spring acting only as an accelerator. The form of blade used gives a good springy contact, and the porcelain walls prevent all possibility of arcing to the case. Micanite insulation is used throughout, and the mechanism is so interlocked that the switch cannot be put on while the case is open, nor can the cover be opened while the switch is on. The cables lead directly into the wiring terminals, which are embedded

in porcelain. A variety of adapters are made to suit every class of conduit or wiring system. The cases are coated inside with a special silicate enamel, and the exteriors are



DOUBLE-POLE INTERLOCKED WATERTIGHT IRONCLAD SWITCH.

stove-enamelled at a high temperature. An earthing terminal is fitted, of the size recommended by the I.E.E. Only the 25-ampere is made at present.

INDIRECT LIGHTING

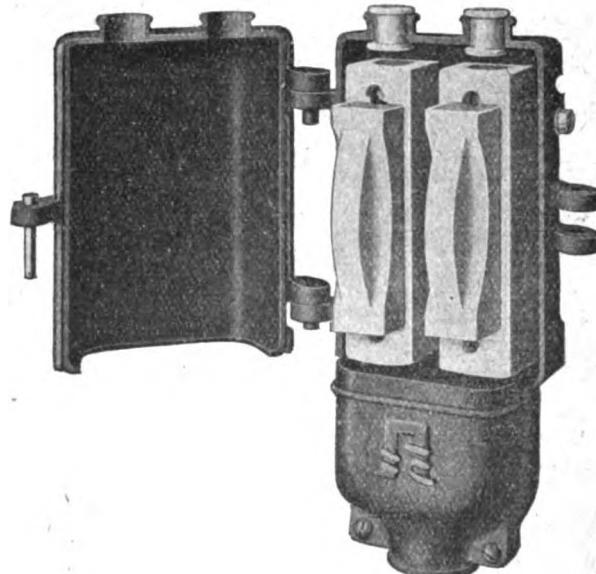
A NEW catalogue of fittings for indirect lighting has been produced by the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), who have long championed this restful form of illumination. It is interesting to compare their new list, comprising forty pages describing some fifty different types of fitting, with one dated May, 1912, of eight pages only, listing only two varieties. The prices, also, are reduced by about 33 per cent. since that time. The forms of fitting now listed include the original metal and composition suspended bowls, of which many new designs appear, including the recently-introduced luminous bowls with panels of coloured translucent glass, special dining-room fittings throwing a certain amount of light down on the table, as well as the powerful upward light, and a special hospital fitting with a glass dome over the bowl to exclude dust. Some very fine flambeaux-type wall brackets in metal and composition are also listed, as well as pedestal fittings and floor and table standards, all equipped with the upturned "X-ray" silvered glass reflectors, the efficiency of which has contributed so much to the success of the system. A special feature is the collection of fittings for use with half-watt lamps, a source eminently adapted to indirect lighting. We have from time to time illustrated most of the novelties as they came out,

SINGLE LIGHT INDIRECT FITTING, SHOWING METHOD OF ATTACHMENT OF REFLECTOR.

and we take the opportunity now of giving a representation of an entirely new inexpensive arrangement for applying reflector bowls to single lamps suspended in the ordinary way. A series of illustrations of actual installations give an idea of the fine effect produced and the extent to which the name "Eye-rest" identified with this system of lighting is justified.

AN IRONCLAD HOUSE SERVICE SET

IN order to provide a compact self-contained house service set cheaper both to buy and instal than the form with a separate sealing trough, the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), have introduced the ironclad set illustrated here, consisting of a pair of 10-ampere porcelain-clad Home Office type fuses mounted in a cast-iron case which forms part of the main casting of the split sealing trough. No parts



SELF-CONTAINED FUSE BOX AND SEALING TROUGH.

have to be removed for screwing to the board on which it is mounted, and the cable is taken straight from the sealing trough into the bottom terminals of the porcelain-clad fuses. With the cover open it is impossible accidentally to touch any live part. The whole apparatus weighs only 5 lb., and the overall dimensions are 9½ in. long by 5½ in. wide by 3½ in. deep; the set is available in both side and bottom entry patterns.

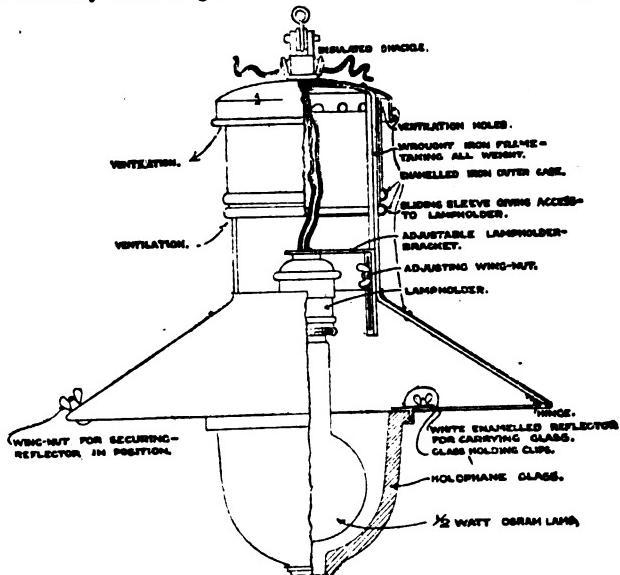
BRITISH MADE OPAL SHADES

THE old-fashioned conical opal shade, notwithstanding the existence of many less primitive patterns, has long retained its popularity owing partly to its cheapness. Unfortunately, however, the supply has hitherto been almost entirely from enemy countries. To meet this situation, the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), in conjunction with an old-established firm of English glass manufacturers, have introduced a new and improved opal shade of pleasing appearance, pure colour and excellent reflecting quality. The shape is such that the filament of a tungsten lamp is in its correct position for maximum efficiency. The design involves a "Ogee" curve, as shown in the figure. Two standard sizes are stocked, the smaller one 7 in. diameter by 4 in. deep, and the larger 9 in. diameter by 4 in. deep. Although the prices naturally show an increase upon those of the foreign article, the Company feels sure that the consumer will willingly pay the increased price for a British product of pleasing appearance and higher efficiency.

The Electrical Engineer's Diary.—The 1915 edition of this Diary, published by Messrs. S. Davis & Co., 30 and 31 St. Swithin's Lane, E.C., contains, in addition to the diary, the usual exhaustive information relating to electric supply and the application of electricity to various industries. The portion devoted to technical terms and definitions has been amplified and is provisionally approved by the British Electrotechnical Committee. The volume also contains the various Government departmental regulations and the Institution Wiring Rules, in addition to useful notes on subjects of interest to those engaged in central station work. A separate section is devoted to lighting, cooking, and heating.

A HALF-WATT STREET LANTERN

WE have received from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), some particulars of a new lantern for street-lighting purposes, which possesses some interesting features. It is known as the "County" lantern, and is provided with a Holophane globe, giving a remarkably wide angle of illumination. It is well designed

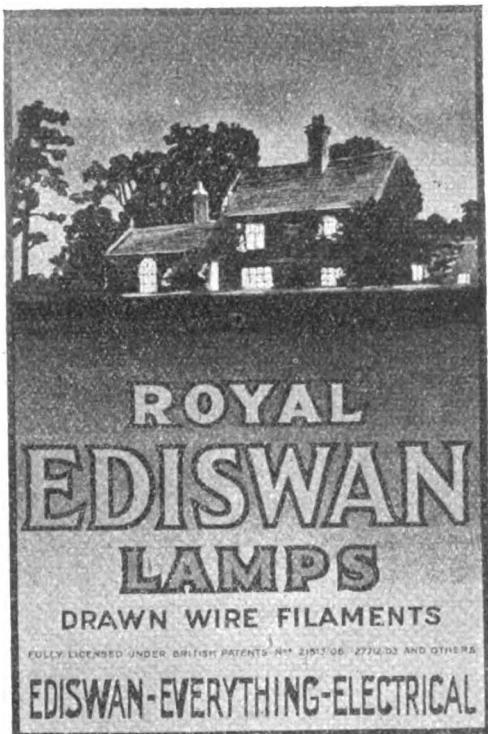


"COUNTY" LANTERN FOR HALF-WATT LAMPS.

as regards ventilation and simplicity of connections, and a sliding sleeve giving free access to the lampholder is provided to fit into an adjustable bracket to which the holder is attached, enabling perfect accuracy of focussing to be obtained. The lantern has a workmanlike appearance, and is finished in either vitreous enamelled or stove Japanned iron.

AN EFFECTIVE ADVERTISEMENT

WE illustrate here a new design which the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex, and 123-125 Queen Victoria Street, E.C.), have



brought out as a transparency for fixing in their customers' windows, show-cases, &c. The effect from the white windows is excellent, and the artistic design of the transparency makes it most popular.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Brisbane Deputy Postmaster-General requires tenders by March 10th for a motor-generator, power board, telephone test board, &c. Further particulars at 72 Victoria Street, S.W.

Bedale (Yorks).—A local company has been formed with a capital of £3,000 to supply electricity in this district.

Clacton-on-Sea.—A new battery is to be installed at the electricity works.

Darlington.—The scheme of extensions briefly referred to in our last issue includes a 2,000 or 3,000-kw. generating set, three boilers, an economiser, and a travelling crane.

Hazel Grove.—Mr. T. L. Miller is to report upon an electric lighting scheme.

Holmfirth.—The Board of Trade has now sanctioned the scheme by which the Yorkshire Electric Power Co. will supply the Council in bulk.

Ipswich.—Coal elevating and conveying apparatus; coal bunkers; waggon-tipping gear. Borough Electrical Engineer. January 22nd.

Limerick.—An expenditure of £5,000 is to be incurred upon new generating plant.

Liverpool.—An electrically-driven drainage pump is required for the Canada Graving Dock, at an estimated cost of £550.

Manchester.—An expenditure of £20,000 on services and mains is contemplated.

Newcastle West (Ireland).—An electric lighting scheme by Mr. W. Phelan, J.P., a local resident, is under consideration by the Council.

Walsall.—A supply of electricity is to be given by the Corporation to the new pumping station in Rushall.

Waterford.—Mr. G. M. Lacey, the Council's consulting electrical engineer, has submitted two electric supply schemes involving the use of oil engines and steam engines respectively. These are now under consideration by the Electric Lighting Committee.

West Bromwich.—A loan of £2,997 is to be taken up for new plant.

York.—A L.G.B. inquiry was held last week in connection with loans as follows:—Mains, £11,400; services, £1,700; motors, £800; sub-station buildings, £500; plant, £4,400; transformers, £750. It was explained to the Inspector (Mr. H. R. Hooper) that the reserve fund at present stands at £55, and that although at the beginning of the past financial year there was a balance of £2,867, an outstanding liability of £2,812 had been paid off. The Inspector also criticised the policy of the Council in making a large reduction in price, which had, he said, practically had the effect of reducing the reserve fund to nothing. Although the output in 1913 was 500,000 units more than in the previous twelve months, the works costs, he added, had increased by a twelfth of a penny per unit, and the cost of coal was not likely to go down. Alderman Meyer, Chairman of the Electricity Committee, defended the action of the Corporation in reducing the price, notwithstanding that this had resulted in a drop in profits from £4,000 to £800 in one year. He contended that this was what an ordinary manufacturer would do to increase his business, and looked forward to such an increase in this instance.

Wiring

Bacup.—Fire station.

London: L.C.C.—260 wiring points at Exmouth St. Elementary School, Hampstead Road, N.W. (See an advertisement on another page.)

Oldham.—Council school, Higginshaw. Architects, Winder and Taylor, Union Street.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barnet.—New municipal offices (£4,000).

Liverpool.—New parcel office, Hatton Garden. Assistant Architect, H.M. Office of Works, Bank Buildings, Derby Square.

Wigan.—Extensions to infirmary. Architects, Ralph & Son, Leader's Buildings, King Street.

Miscellaneous

Australia.—The Sydney Deputy Postmaster-General requires switchboard materials and 312 yds. of switchboard cable.—The Perth Deputy Postmaster-General requires telephone switchboard cords and switches. Feb. 10th. Further particulars in both cases at 78 Basinghall Street, E.C.

Doncaster.—Six trams are required at an estimated cost of £5,600.

Manchester.—Electrically-operated penstocks. Secretary, Rivers Committee, Town Hall.

Spain.—Four electric cranes. "Junta de Obras del Puerto de Valencia," Valencia. Feb. 10th. Further particulars at 73 Basinghall Street, E.C.

TENDERS RECEIVED AND ACCEPTED
AND ORDERS PLACED

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for the supply of Wotan, Tantalum, and carbon-filament lamps for the Aberdeen White Star Line.

MISCELLANEOUS BUSINESS NOTES AND
TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £68 10s. to £64. (Last week, £60 15s. to £61 5s.)

German Electrical Industry.—The *Board of Trade Journal* states that German manufacturers have established agents in Amsterdam who carry stocks of dynamos and motors for sale to wholesale dealers on thirty days' terms. It is pointed out that as there appears to be a good opening in this class of goods for United Kingdom manufacturers, these latter should appoint agents, and quotations should be made c.i.f. Amsterdam.

Russian Agency.—A Warsaw firm desires to get into touch with United Kingdom manufacturers of dynamos, electric fans, lighting accessories, installation materials, telephones, bells, &c. Further particulars at 73 Basinghall Street, E.C.

Spagnoletti, Ltd.—Messrs. Spagnoletti, Ltd., have gone into voluntary liquidation for the purpose of reconstruction under the new title of The Park Royal Engineering Works, Ltd. The Company, which was established in 1851, is erecting model factories upon an extensive site at Park Royal, but, notwithstanding the change in title, the directors and staff, except for certain additions, are the same. The new factories, we understand, have been planned to deal with the firm's special requirements in their manufactures for the Admiralty, War Office, municipalities, railways, &c., and with the up-to-date plant being installed a very large output of modern switchgear, instruments, and special apparatus will be handled.

Mossay & Co.—This firm has removed from Horseferry Road to Queen Anne's Chambers, Westminster. Arrangements have been made with Messrs. Ransomes, Sims & Jefferies, Ltd., of Ipswich, for the manufacture and sale of their "Orwell" electric vehicles.

Bankruptcy.—The public examination of G. E. Hipkins, Electrical Engineer, 48 Wolverhampton Street, Dudley, took place last week. The liabilities amount to £510 and the deficiency £386. The cause of the failure is mainly attributed to loss on a cinematograph theatre.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. H. Klein, Secretary of the Wireless Society of London, asks us to point out that, although his name has a somewhat German sound, he is a Belgian and a naturalised British subject, and a Licentiate in Consular Sciences at Antwerp.

Mr. J. D. Spark, Mains Superintendent at Swansea, has resigned to take up a similar position at Walsall.

The King's Lynn Corporation requires a Chief Assistant Electrical Engineer. (See advertisement on another page.)

An Engineer-in-Charge is required in the Sunderland Electricity Department. (See advertisement on another page.)

Particulars of vacancies for shift engineers, temporary switchboard attendants, and wiremen are given in our advertisement columns.

LOCAL NOTES

Doncaster: Municipal Wiring.—As in Edinburgh, the Doncaster wiring contractors are already taking steps to combat the scheme of the Corporation to obtain municipal wiring powers. The Mayor of Doncaster, who is also Chairman of the Doncaster Tradesmen's Association, has expressed himself in undoubted terms against the Corporation's proposal, and has intimated that he will vote against it.

London: Hammersmith: The Power Supply Schemes.—The Council is recommended by the Law and Parliamentary Committee to petition against both the London electric power Bills. With regard to the three questions asked by the L.C.C., set out on p. 10 of our last issue, the opinion is expressed that the Hammersmith Council will be prepared to take up the question of greater uniformity of supply than at present when the need is shown; that this can be done by the existing supply authorities under the Electric Lighting Act of 1909; and that neither the L.C.C. nor the Companies Bill offers any advantage to existing suppliers.

Newport (Mon.): Shortage of Labour.—The Borough Electrical Engineer has reported a difficulty in filling vacancies on his staff through enlistment, and states he has been obliged to offer increased wages, and to guarantee employment for a definite period, in order to obtain men.

Peterborough: Street Lighting.—In a report upon the future policy as to street lighting, the Borough Electrical Engineer recommends that all arc lamps should be discontinued and replaced by metal-filament lamps. He has been instructed to obtain specimen lanterns.

South Africa: Power Co.'s Progress.—The Victoria Falls and Transvaal Power Co. states that the business continues to make satisfactory progress, and that the war has not interfered with the undertaking. The profits show a steady increase since the beginning of last year, and the first extension of the set at the Brakpan power-house will be in commission in February. A second set it is anticipated will be ready two months later.

Watford: The "Norwich" System.—The Electrical Engineer has been instructed to report upon the working of the "Norwich" system of charging.

Wolverhampton: Supply in Bulk.—The Board of Trade has issued an order authorising the Midland Electric Corporation for Power Distribution to supply electrical energy in bulk to the Corporation.

The L.C.C. Power Scheme.—A correspondent who signs himself "Londoner" sends us a long communication in which he points out that the opposition to this scheme is getting so pronounced that it is questionable whether the L.C.C. will proceed with the Bill, even as far as the second reading. He contends that the huge weight of opposition from the Councils in outer London could have been dispensed with by leaving these out of the scheme without affecting it vitally. The only point in including them, he says, seems to be the purely theoretical idea of completeness. The special Electric Supply Committee of the L.C.C. has, our correspondent proceeds, ridden rough shod over the interests of both municipal and company undertakers, without practical consultation. He doubts whether anybody beyond the engineers who have prepared it, a small proportion of the Electric Supply Committee, and possibly a very meagre sprinkling of members of the L.C.C., are really in favour of the scheme.



ELECTRICAL ENGINEERING

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(Established 1884)

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SUMMARY

A COMPLETE study of the shape of the no-load-pressure wave in alternators and the methods of eliminating harmonics therefrom was contained in a Paper by Dr. S. P. Smith and Mr. R. S. H. Boulding, read at last Thursday's meeting of the Institution of Electrical Engineers (p. 22).

WE publish a list of the members of various classes of the Institution of Electrical Engineers who are on military service. The total number up to the present is 593, representing 8½ per cent. of the membership. No less than 228 out of the 986 students have joined, a percentage of 23 (p. 23).

THE design of reactances for current limitation in feeder circuits is discussed in our "Questions and Answers" columns (p. 24).

WE give some further particulars of the temporary 10,000-kw. generating station which the Birmingham Corporation are putting down owing to demands for power from manufacturers of war material (p. 25).

THE opposition to the two electric power Bills affecting London promises to be of a most formidable character (p. 25).

AMONG the subjects of specifications published at the Patent Office last Thursday were two methods of producing continuous waves for wireless telegraphy, and the regulation of converting plant. Two applications for the suspension of enemy-owned patents relating to electric ignition apparatus have been success-

ful. A patent for telephone party line working expires this week, after a full life of fourteen years (p. 26).

IN a Paper before the Institution of Post Office Engineers, Mr. S. C. Bartholomew describes methods of avoiding interference between power and communication circuits. Some interesting particulars as to the organisation and work in connection with the Army Telegraph Service are given in our notes on Telephony and Telegraphy (pp. 26 and 27).

A MERCURY vapour rectifier locomotive is undergoing trials in actual service in America (p. 27).

ARTICLES on an ironclad change-over switch, an improved Röntgen ray tube, marine telephones, and a method of leakage protection for motors appear in our "Trade Section" (pp. 28 and 29).

A 500-kw. turbo-generator is required at Hove; a 120-kw. set at Beckenham; two 1,000-kw. sets at Redditch, and services and transformers at Harrogate. The Truro lighting scheme is going forward; a loan of £30,000 has been granted at Greenock, and further extensions are contemplated at Barrow (p. 31).

SHEFFIELD electrical contractors are to take proceedings against the Corporation in regard to the Sales Department.—Edinburgh Corporation intends to continue with its application for municipal wiring powers (p. 32).

THE ILFORD CASE

THE Ilford Urban District Council has consented to declarations that the hiring of arc lamps, motors, &c., and the running of a showroom has been carried on by them illegally, and further that their tariff which offers better terms to consumers who have their premises lighted by electricity only is also illegal. Thus ends the action against the Council by the Ilford Gas Co. This result was announced in the Chancery Division before Mr. Justice Sargent yesterday. We will refer to the matter in greater detail next week.

Arrangements for the Week.—(To-day) Thursday, Jan. 21st.—Greenock Electrical Society, 21 West-Stewart Street, Greenock. "Electricity in a Shipbuilding Yard," by Duncan Angus, 7.45 p.m.

Saturday, Jan. 23rd.—Association of Mining Electrical Engineers, West of Scotland Branch, Royal Technical College, Glasgow. Joint meeting with National Association of Colliery Managers. "Electricity at the Coal Face," by John Bowman, 4.30 p.m.

Association of Mining Electrical Engineers, Notts and Derbyshire Branch, at University College, Nottingham. (1) "Some Power Station Details," by C. Lewes. (2) "Surface Earthing at Scottish Mines," by P. S. Glover, 3.30 p.m.

Tuesday, Jan. 26th.—Institution of Electrical Engineers, Manchester Section, Engineers' Club, Albert Square. "Electric Steel Making Furnaces," by T. D. Robertson, 7.30 p.m.

Wireless Society of London, at I.E.E., Victoria Embankment. Presidential Address by A. A. Campbell-Swinton, 8 p.m.

Thursday, Jan. 28th.—Institution of Electrical Engineers. Sixth Kelvin Lecture. "Lord Kelvin's Work on Gyrostatics," by Prof. A. Gray, F.R.S., 8 p.m.

THE SHAPE OF THE PRESSURE WAVE IN ELECTRICAL MACHINERY

A PAPER with this title, by Dr. S. P. Smith and Mr. A. R. S. H. Boulding, was discussed at last Thursday's meeting of the Institution of Electrical Engineers. The first section of the Paper discussed the classification of windings, dividing them into single-layer and double-layer windings, the former generally used for high pressures where there are several conductors per slot and essentially open windings, and the latter connected lap or wave, forming either ordinary open windings with the coils in two layers or open or closed commutator windings. Closed windings were seldom used for alternating current except with commutators. With regard to uniformly distributed windings it was seen that where the number of slots per pole is an integer, and a normal arrangement of slots and poles is adopted, the effect of the teeth will be greatest. When the poles or slots are skewed in such a manner as to make the conductors occupy all possible positions in the field, the winding is equivalent to a uniformly distributed winding, and the effect of the teeth is nil. When the pole-shoes are displaced, or the number of slots per pole is fractional, the equivalent distribution of the winding is increased. With respect to the effect of the teeth on the shape of the pressure wave, these intermediate cases give practically the same result as a uniformly distributed winding. In all cases, therefore, where there is an abnormal arrangement of the field or armature system, or a fractional number of slots per pole, it is allowable in practice to regard the winding as uniformly distributed.

The authors investigated mathematically the general expression for the E.M.F. induced in a coil, taking into account the effect upon the presence of harmonics of the coil span for various flux distributions with salient and non-salient poles, incidentally bringing out the point that there can never be a third harmonic in the line pressure of a star-connected three-phase generator, nor in the alternating pressure of a three-phase rotary-converter, nor in the phase pressure when each phase extends over $2/3$ of the pole pitch, nor in the pressure of a single-phase alternator with two-thirds of the periphery wound. This also holds when the winding is placed in slots instead of being uniformly distributed.

The effect of the slots on the "distribution factor" and the "group factor" were investigated, and the analytical argument was admirably illustrated by oscillographs.

Summing up, the authors write that the spacing of the armature slots has a selective influence—with a normal arrangement of slots and poles all the harmonics in the B-curve are reproduced in the pressure induced in each conductor or full-pitch coil, but in the phase and terminal pressures most of these are practically suppressed by their low winding factors, whilst others of the orders $2Q \pm 1$ (where Q =the number of slot-pitches per pole-pitch) appear very pronounced because their distribution factors approach unity. Before a harmonic can appear at all in the pressure, it must exist in the B-curve—always assuming the latter to be steady. The winding factor only selects some of these and suppresses the others, and so produces the spacing ripple. A wave with a pronounced ripple may have fewer harmonics than a smooth wave: for instance, if a particular harmonic, say the fifth, were suppressed from the rectangle, the resultant curve would not be nearly so smooth. The spacing ripple in salient-pole machines is chiefly important with two or three slots per pole and per phase, and unless one of the several methods for making the winding-factor very small is used, it is generally advisable when a smooth pressure wave is needed, to round off the pole tips so as to reduce the harmonics in the B-curve. With non-salient-pole machines the number of stator slots per pole is generally larger, and the chief care must be taken to avoid clashing with the number of teeth on the rotor. An inspection of the expression for the distribution factor will show that for the n th harmonic, it can be made zero in the same way as with uniformly distributed windings, so that the terminal pressure of a winding filling two-thirds of the slots will have no harmonics, the orders of which are multiples of three. Hence, with a steady flux, to obtain a pressure at the terminals free from harmonics there must either be no harmonics in the B-curve, or their winding factors must be so low as to make them negligible. In the case of the tooth effect, the winding factors in question can be made very small by making Q a fraction, or by skewing the slots, or by skewing or displacing the pole-shoes.

The effect of flux pulsations due to the teeth was then investigated; the true tooth ripple was shown to have very little effect, as there is always a tendency for oscillations in the

magnitude of the flux to be damped out by eddy currents and currents induced in the exciting winding. The ripple caused by swinging of the total flux is of greater importance, and this is investigated mathematically and by aid of oscillograms at length in the Paper. The effect of swinging is to produce a ripple of frequency $2Q$ times that of the fundamental, whilst its amplitude is proportional to the electro-motive force. The amount of flux swinging depends largely on the constructional details of the machine, such as the number of slots per pole, the ratio of slot-opening to gap, the skewing of the slots or pole-shoes, &c., and by suitable design it can be made fairly small. The commonest method for reducing the swing is to use nearly closed slots. There are external methods of suppressing the tooth ripple from the terminal pressure. For example, a method that has found favour of late years has been the use of a resonance circuit across the terminals of the machine, adjusted to resound with the frequency of the tooth ripple; though in most cases the addition of one or two extra slots would certainly be a much cheaper and an effective way of preventing disturbances in telephones.

The latter part of the Paper, for which Dr. Smith is responsible, deals with a method of vector analysis applicable to these and other problems connected with armature windings.

The discussion was opened by Prof. Silvanus P. Thompson, who appreciated the way in which the authors had arranged their facts in logical sequence without paying attention to priority of discovery. Valuable work has been done on the subject by American investigators, whose oscillograms were of all the more interest in the light of the present Paper. The authors were particularly happy in the way in which they had disentangled the effects of ripples from different causes. There were one or two matters of nomenclature that he protested against, such as the use of the word horn for the centre of the pole instead of the pole tip. He thought that the most satisfactory way of avoiding the presence of harmonics was to shape the pole pieces so that they were completely absent from the flux wave rather than getting rid of them afterwards. One of the most real advantages of salient poles was the way in which they lessened the effect of armature reaction. He noted how often the expressions as $\sin \theta/\theta$ and $\sin n\theta/n \sin \theta$ occurred in the mathematics in the Paper, and proposed that these should be known by the special names "cursin θ " and "pursin (n) θ ," and should be tabulated for ready use in such calculations. He regretted that the Paper stopped short at no-load conditions.

Mr. H. Burge (Crompton & Co.) said that salient poles were much more difficult to construct satisfactorily in turbo-alternators. He did not quite approve of the authors' classification of windings, and thought that a further investigation of the conditions on load would throw interesting light on the working of alternators with high reactance, such as were often used to limit the short-circuit current.

Mr. C. C. Hawkins referred to the method of suppressing harmonics by a wind coil connection developed by Prof. Adams in America. High harmonics, even when reduced to a percentage that appeared satisfactory on an oscillogram, might, he said, still give trouble when conditions of resonance were present. Now that they had such complete means of ensuring the absence of the principal harmonics, including the triple frequency harmonic, it was possible that a return might be made to most connected windings, which were very convenient under certain conditions. He thought that the authors' remarks on flux swinging were a little vague, and was not satisfied as to the correctness of one of the diagrams.

Mr. A. R. Everest (B.T.-H. Co.) was a little disappointed not to find more practical comparison of the different methods of suppressing harmonics, and to the very different conditions obtaining on load. He did not agree with Dr. Smith as to the advantage of non-salient poles, and thought that as near an approximation to a sine curve could be obtained with a salient pole. The authors' proposed remedy of skewing or staggering the slots would lead to difficulties in manufacture. The amortisseur slots also had some influence on the form of the pressure wave. Unequal spacing of the slots was, of course, impracticable, but the use of a practical number of slots per pole was a remedy often used. Some sort of standard specification of wave form was required. In America it had been suggested that no harmonic should exceed the fundamental wave in amplitude by more than 10 per cent. Another method of testing the wave form was by taking measurements of the capacity of a condenser with the wave to be tested and comparing the result with that for a pure sine wave.

Dr. G. W. O. Howe spoke at some length on the swinging of flux in the teeth, and vigorously defended the author's diagram attacked by Mr. Hawkins.

Mr. Jacob pointed to the remarkable agreement between the calculated wave forms and actual oscillograms in the Paper. The use of a few empty slots gave satisfactory results in single-phase machines, but was not very practicable in polyphase generators. In such machines as rotary converters the effect of the tappings often gave more trouble than the ripples from causes that had been discussed.

ELECTRICAL MEN ON ACTIVE SERVICE

THE Institution of Electrical Engineers has prepared a list of their members on military service, several of whom have left important positions to join the colours. The total is 593 out of a membership of 7,040—i.e., about 8½ per cent. This, of course, represents only a portion of the total contribution of the electrical industry to the naval and military forces. Three of the largest electrical manufacturing works have sent out about 1,000 men each, and, at a rough estimate, about 10,000 workmen have gone from works of this class. To this must be added the employees of electric light and tramway undertakings and the electrical men on the railways, and the total is probably well up to 20,000 all told. It must not be forgotten that the electrical industry is one which must be worked to its fullest capacity during wartime. All the larger works are as busy as they can be on work arising directly out of the war, and, in addition, the electricity works, railways, and tramways must be kept going; so it speaks well for the patriotism of all the workers in the industry that this large number of men have gone for active service.

The most noticeable feature in the Institution list is the large proportion of students who have volunteered for military service. Out of 986 students, 228 are now in the Army or Navy—actually 23 per cent.

The following is a list of the Members on active service. In the case of members who were in the regular Army or Navy before the war, their rank is given before their name, in the other cases after.

Col. A. H. Bagnold, R.E.; E. A. Barker (Borough E.E., Barnsley) Lieut. and Qmr. 5th York & Lancs. Regt.; D. Bates (Works Manager, British Insulated Co.) Lieut.-Col. 5th Sth. Lancs. Regt.; V. B. D. Cooper, Major, R.E.; J. M. Donaldson (North Met. Elec. Power Co.) Capt. 16th King's Royal Rifle Corps; Major A. H. Dumaresq, R.E.; K. Edgcumbe (Everett, Edgcumbe & Co.) Major, London Elec. Eng. R.E.; R. W. Hammond, Capt. 19th Royal Fusiliers; General and Col. Commandant Sir R. Harrison, G.C.B., C.M.G., Royal Engineers; S. B. Haslam (Haslam & Stretton, and Hon. Sec. Cardiff Section I.E.E.) Lieut. 5th Welsh Regt.; Prof. J. B. Henderson (Borough Polytechnic) Admiralty Staff Duty; Col. H. C. L. Holden, C.B., F.R.S., Director Mechanical Transport; Prof. B. Hopkinson, F.R.S., Major Cambridge Univ. O.T.C.; H. L. Howard, Lieut. R.E., T.F. Reserve; A. H. Law (Managing Director, C. A. Parsons & Co.) Capt. 1st Northumbrian Brigade R.F.A.; F. A. Cortez Leigh (Elec. Eng. L. & N. W. Rly.) Lieut.-Col. Western Signal Service, R.E.; A. E. Le Rossignol, Lieut.-Col. London Elec. Eng. R.E.; J. F. Lister (Veritys, Ltd.) Lieut.-Col. Southern Signal Service R.E.; W. McLellan (Merz & McLellan) 2nd Lieut. 17th Northumberland Fusiliers; Major W. A. J. O'Meara, C.M.G., R.E.; Major-General R. M. Ruck, C.B., R.E.; Capt. H. R. Sankey, R.E.; H. C. Sparks, 2nd Lieut. London Scottish; C. S. Stafford (Asst. Managing Director, Dick Kerr & Co.) Lieut. A.S.C.; R. Stanley (Belfast Mun. Tech. Inst.) Capt. R.E.; Brig.-General A. M. Stuart, Director of Works; C. D. Taite, Capt. 8th Lanc. Fusiliers (Reserve); Viscount Templetown, Lieut. (Staff Censor's Office); T. Tomlinson (Hon. Sec. I.E.E. Dublin) Asst. Div. Off., South Dublin Dist. R.E.; T. M. W. Wallis (J. H. Holmes & Co.) Sub-Lieut. R.N.V.R.; R. J. Wallis-Jones, Capt. 4th Welsh Brigade, R.F.A.; Major R. ff. Willis, R.M.L.I. J. C. Chambers (Lieut.-Col.), R. De Valbreuze (Lieut., Wireless Corps, French Army), F. T. Hall, A. Handley (Capt.), H. D. W. Lewis (Officer Commanding, 1st Field Ambulance, Welsh Army Corps), A. E. Loos (Lance-Corpl.), W. H. U. Marshall (2nd Lieut.), W. L. Maxwell (Corpl.), P. D. Michod (Capt.), G. T. W. Olver (Capt.), A. P. Pyne (Lieut.), F. O. J. Rouse (Lieut.), G. Seligmann-Lui (Lieut.-Col., French Army), C. Wade (motor-driver, French Red Cross), J. Wayne-Morgan (Lieut.), H. O. Wraith (Lieut.), and H. W. Young (Lieut.).

In addition, the following members have joined the Anti-Aircraft Corps (R.N.V.R.) :—

C. W. S. Crawley (Chief Petty Officer), H. T. Harrison, F. B. O. Hawes, F. Pooley, N. W. Prangnell, and H. W. Ridley.

The Associate Members are :—

G. C. Allingham (Tudor Co.), Lance-Corpl., Divisional Engineers, R.N.D.; B. Binyon, Lieut. Royal Naval Air Service; W. E. Brandreth, (Eng. & Manager, Wycombe Elec. Light & Power Co.) Capt. 7th Essex Regt.; Capt. D. S. Collins, R.E.; J. G. Cunliffe (Birmingham Trams) 2nd Lieut. 18th Manchr. Regt.; R. G. Cunliffe (Manchester Trams) 2nd Lieut. R.G.A.; Capt. A. E. Davidson, R.E.; W. P. Dibby, Lieut. London Elec. Eng. R.E.; H. Emmott (Halifax) Sergt. R.A.M.C.; Capt. E. O. Henrici, R.E.; L. B. Hogarth (Boro' E.E. Whitehaven) Lieut. 11th Border Regt.; E. S. Hurlbatt (Dick, Kerr & Co.) 2nd Lieut. 7th Manchester Regt. (1st Res.); G. W. C. Kaye (N.P.L.) Capt. London Elec. Eng. R.E.; Capt. H. P. T. Lefroy, R.E.; F. H. Masters (Asst. Editor, *Electrician*) Capt. London Elec. Eng. R.E.; A. E. Mayes (Chief Engineer, I.O.W. Electric Co.) Major, 8th Hampshire Regt.; W. H. Merrett (Royal School of Mines) Capt. London Elec. Eng. R.E.; G. C. Milnes (Boro'

Elec. Eng. Lancaster) Lieut. 5th Royal Lancaster Regt.; N. Mitchell, Lieut. Royal Naval Air Service; B. J. Moore, Pilot, Royal Flying Corps; H. E. Morrow (L.C.C. Paddington Tech. Inst.) Lieut. Div. Eng., R.N.D.; K. A. Mountain, Lieut. Tyne Elec. Eng'rs, R.E.; L. G. E. Morse, Lieut. London Elec. Eng'rs, R.E.; R. L. Pearson (Reading University) Capt. Berks. Yeomanry; Lieut.-Comr. R. F. Pitcairn, R.N.; T. Rich, Capt. London Elec. Eng'rs, R.E.; A. N. Rye (Chief Engineer, Guernsey Elec. Light & Power Co.) 2nd Lieut. Royal Guernsey Engineers; F. B. Shaw (Manchester School of Technology) Lieut. Royal Naval Air Service; G. H. Spittle (G.W. Rly. Elec. Dept.) Major Div. Eng'rs, R.N.D.; O. Thornycroft, Lieut. R.N.V.R.; N. B. Tomlinson, Flight-Lieut. Royal Naval Air Service; Lieut. H. de C. Toogood, R.E.; S. Utting (London Repr. L. Prat, Paris) Lt. A.S.C.; Capt. O. T. Webber, R.E.

J. N. Alty, R. Amberton (Lieut.), H. G. Andrews (Sub-Lieut.), A. S. Angwin (Major), A. Ardern, C. L. Arnold (2nd Lieut.), A. H. Atkins (Lieut.), F. R. Bader (Major), T. C. Baillie (Lieut.), H. R. Baldwin (Sub-Lieut.), H. K. Benson (2nd Lieut.), M. G. Bland (2nd Lieut.), R. B. Bowker (Major), G. F. Boxall, W. B. Boyd, G. Bradwell (Lieut.), H. A. Brimelow, R. A. Broad (Lieut.), G. J. L. Brown (Lance-Corpl.), H. Brown (Capt.), T. A. Brown, W. Brown, W. F. Brown (Lance-Corpl.), J. Bruce-Kingsmill (Lieut.-Col.), W. W. Buckton, A. W. Bullough, W. Bunn (Capt. and Hon. Major), C. M. Campbell (Capt.), H. Carey-Thomas (Capt.), W. M. Carver (Lieut.), T. Challoner (2nd Lieut.), F. J. Chapple (Capt.), H. Church (Corpl.), R. W. Clark, F. C. Clarke (Lieut.), J. F. Clunas, J. C. Connan (Lieut.), H. A. Cope (Lieut.), H. Corney (Sergt.), H. G. B. Cresswell (Lieut.), C. E. Crossley, C. H. Davidson (Actg. Bombardier), L. H. Davies, V. O. I. Davis (2nd Lieut.), H. J. G. Davison, A. J. Dickinson (Major), T. F. Dillon, W. Dobson (Eng. Commr.), J. W. Dodds (Lieut.), J. Dubbin (Sergt.), F. P. Dumjoh (Sergt.), E. J. Dutch, H. A. Edger, E. P. Elwin, G. G. Ewer (Capt.), S. K. Ferrier, F. W. Foster (Lieut.), R. A. Frank (Sergt.), H. W. Franks (2nd Lieut.), A. R. Fraser (Sergt.), G. G. Fraser, R. H. Friend, P. B. Frost, W. P. Fuller, A. E. H. Gates (Corpl.), F. W. Geoghegan (Lieut.), J. S. Gibson, J. Gilbert, C. H. Goulden (2nd Lieut.), C. B. Grace (Capt.), T. R. Graty, R. Grierson (Lieut.), E. E. Grover (Lieut.), W. L. D. Gundry (Lieut.), C. S. Hann, C. C. A. Hardie (Lieut.), L. Harris, H. M. Harrison, H. M. Hart, G. F. Herron (Lieut. R.N.A.S.), C. Higgins (Lieut.), F. A. Hill (Sergt.-Major), R. Hills (Capt.), L. W. Hipwell (2nd Lieut.), W. Hodson, H. N. Holland (2nd Lieut.), A. J. Hollington, H. C. Holroyd (2nd Lieut.), S. J. Hough (2nd Lieut.), E. Hoyle (Corpl.), S. W. Humphrey (Major), W. H. Hunstone, E. B. Hunter (Lieut.), J. C. Hutton (Corpl.), F. A. Iles (Major), E. W. Jackson (Sergt.), L. E. S. Jackson, A. L. Johnson (Sergt.), E. W. Kay, G. W. Kidd (Eng. Lieut.), H. F. A. Kinder (2nd Lieut.), H. M. Kirkby (Sergt.-Major), W. D. Kirkpatrick, L. Lamb (Lieut.), J. W. Law (Lieut.), F. A. Lawson, E. Lefeaux (Capt.), C. G. Le Feuvre, A. E. Levin (Capt.), N. V. Lloyd, J. C. Lyell, A. J. P. McCarthy, A. McNaughton (Major), G. G. Mallinson (Capt.), J. A. Manners-Smith, H. H. S. Marsh (Major), D. Martin (Col. Sergt.), I. W. Massie (2nd Lieut.), S. Mathews (2nd Lieut.), K. G. Maxwell (Capt.), W. Mead, E. Middleton, N. Miller (W.O.), R. C. Milliken (2nd Lieut.), J. L. Moffet (2nd Lieut.), S. E. Monkhouse (Lieut.), W. C. Moore, J. H. Mousley (Major), A. M. Mulliner (Corpl.), James H. Murray, C. B. Nadaud (Sub-Lieut.), F. D. Napier, G. D. Nelson (Chief Petty-Officer, Royal Naval Air Service), V. W. Newman (2nd Lieut.), R. S. Newton (2nd Lieut.), E. Orloff, L. Oulton (2nd Lieut.), H. W. S. Outram (Capt.), L. Owen (Corpl.), W. Pate (2nd Lieut.), H. H. Pearson (Corpl.), B. H. Peter (Sergt.), C. H. Phillips (Corpl.), J. H. S. Phillips (Major), T. F. Phillips, P. C. Pocock (Lance-Corpl.), A. F. C. Pollard (2nd Lieut.), L. H. Pratt, W. F. Price (Capt.), F. D. Pyne (Lieut.), H. K. Reed, T. N. Riley (Lance-Corpl.), A. Roberts, A. H. Robinson (Major), W. R. Rogers (Chief Torpedo Instructor, R.N.), B. Roseveare (2nd Lieut.), G. L. Russell (Lieut.), W. E. Russell, H. R. Sanders, P. P. Sandford (2nd Lieut.), A. H. Schultz (Capt.), J. Scott, R. Scrivener (Lance-Corpl.), E. G. Sheppard (Capt.), N. S. Sim, A. Smith (Elec. Artificer, R.N.), A. B. Smith (Corpl.), A. P. Smith (Capt.), T. A. Smith, K. R. N. Speir (Capt.), B. G. Stewart, H. Stone (Capt.), L. F. Summers (Eng., Mercantile Fleet Auxiliary Branch, R.N.), W. A. Talbot (Corpl.), C. A. Taylor (Sergt.), G. S. Taylor (Lieut.), E. J. Taylor, H. B. Taylor (Lieut.-Comr.), R. D. Thomas-Jones (Lieut.), F. W. Timmis (2nd Lieut.), E. B. Trimmer, H. A. Tulloch, H. E. Turner (Corpl.), H. W. Tyler (Capt.), J. D. A. Vincent (Lieut.), F. M. Walker (Staff Sergt.), W. Watson (Sergt.), H. W. Watts (Capt.), H. E. Webb-Bowen (Capt.), W. Weekes (Sergt.), B. G. White (Sergt.), J. D. White (Lieut.), W. Whitney, O. N. Wightman (Capt.), E. Williams, G. Williamson, W. S. Wilson (Lieut.), A. L. Wood (2nd Lieut.), E. L. Wood, E. H. E. Woodward (Capt.), T. H. R. Wray (Commander), F. T. Wright (Lieut.), C. R. M. Young (Lieut.).

The Associates are :—

Major E. Davidson, Army Ordnance Dept.; Major A. Gardiner, R.E.; R. W. Hughman (Man. Dir. *Electrical Times*) Lieut. 9th Middlesex Regt.; Capt. R. A. McClymont, R.A.; Col. A. C. MacDonnell, R.E.; Sir H. Norman, M.P., Commissioner, British Red Cross; A. M. Ogilvie, C.B., Col., Royal

Engineers (T.F.); Col. H. E. Tyler, R.E.; and C. W. Von Roemer (Chairman, Record Electrical Co.) Lieut. R.F.A.

W. J. Bishop (Qmr. Sergt.), A. E. Briscoe, R. C. G. Clark (Capt.), F. Coutts (Capt.), H. E. Davis (Major), H. A. Denison (2nd Lieut.), F. I. L. Ditmas (Staff Capt.), A. M. Doig, H. L. Downes (Lieut.), H. E. Goody, H. Greenwood, O. P. L. Hoskyns (Capt.), W. L. Johnson (Lieut.-Col.), P. W. McDougall, R. G. Madge (2nd Lieut.), P. H. Marco (Lieut.), C. W. Miller (Lance Corp.), J. C. Y. D. Morgan (Lieut. R.N.), P. W. Northey (Lieut.), S. Pilkington (Lieut.), H. W. Prance (Major), J. W. Punter (Capt.), D. L. Selby Bigge (Major), J. W. Slorach (Lieut.), C. G. Wells (2nd Lieut.), and O. Wheeler.

The Graduates on active service are:—

W. F. Andrews (Sergt.), G. A. Applebee (Qmr. Sergt.), F. S. Beamish, T. D. B. Bowater (Lieut.), E. G. Bowers, C. C. H. Brazier, H. A. Brown (2nd Lieut.), W. S. Browne, F. E. Burnett, Sir J. A. C. Campbell, Bart. (2nd Lieut.), A. F. N. Chandler, A. Douglas, G. H. Eardley-Wilmot (2nd Lieut.), H. Girdlestone, P. Grice, C. A. Grut, F. G. Heymerdingner, T. J. Hornblower (2nd Corp.), R. E. Hume-Williams (2nd Lieut.), F. P. S. Lacey (2nd Lieut.), A. L. Lintott (Capt.), H. J. Loughlin (2nd Lieut.), A. McPherson (2nd Lieut.), G. H. Murphy (Corp.), C. A. Newell (Sergt.), G. Ollier, F. L. Otter (2nd Lieut.), E. A. Pells (Lieut.), F. C. Platt, E. B. Preston (Corp.), W. A. Scotter, J. H. D. Sheppard (Lieut.), T. S. Stout, D. G. Thomson (Capt.), J. W. Treherne, C. Vandermin (Lance-Corp.), and A. N. G. Wood.

The Students on active service are:—

H. G. Byng (Artists Rifles), B. Z. de Ferranti (2nd Lieut., R.G.A.), V. Z. de Ferranti (2nd Lieut., R.E.), and A. C. Sparks (2nd Lieut., R.E.), J. R. Abbott (2nd Lieut.), H. O. Addicott, E. C. Albrecht, C. J. R. Alsford (Sub-Lieut., Royal Naval Res.), G. B. Alvey (Lance-Corp.), S. D. Anderson, T. C. Angus, H. Armstrong (Corp.), J. Aylmer (Lieut.), A. J. Bailey, F. L. Ballard, A. Bannister, E. G. Bannister (Lieut.), L. E. Barnard (2nd Lieut.), W. C. Barnes (2nd Lieut.), E. J. Barnett (2nd Lieut.), A. E. Barter (R.N.V.R.), E. A. Beavis (Corp.), A. L. Bedford, J. T. Bedford (Lance-Corp.), H. G. Bell (2nd Lieut.), B. S. Benning (2nd Lieut.), C. R. Bicknell (2nd Lieut.), E. J. Billington, C. A. Bold, C. R. Bolton, C. W. Bostock, C. W. Boxall, H. P. Bramwell (2nd Lieut.), L. A. T. Broadwood, H. Brooke (2nd Corp.), C. L. Bullock, J. H. P. Burchett, W. B. Burford (2nd Lieut.), R. Burleigh (2nd Lieut.), C. J. Burrage, A. N. Cam, S. A. B. Campbell, G. D. Canton, A. S. Carr (Lance-Corp.), R. L. Castle, G. H. Champ, E. V. Cheney, J. C. Clarke, H. Clausen (R.N.V.R.), D. H. Clifford-Smith (2nd Lieut.), J. P. Clifton (2nd Lieut.), A. G. Colston, W. W. Cooper (Lance-Sergt.), H. W. Corke (2nd Lieut.), E. W. Cosserat (Sergt.), P. J. Cottle (2nd Lieut.), H. S. Craig, A. E. Crampton (Lance-Corp.), C. B. Cripps, E. H. Croft (2nd Lieut.), H. S. Cuerden, P. N. Cunningham, H. H. Curtis, E. L. Damant, H. N. Davis (Lance-Corp.), G. G. Dawson, E. A. Deacon, W. J. F. Debley (Lance-Corp.), M. R. de Cordova (Lieut.), J. G. Deedes (2nd Lieut.), N. Devonald, P. Dobie, J. A. Donald, W. A. Douglas (Capt.), D. Dunham, F. G. Dunn, F. W. Eagle (2nd Lieut.), C. E. Easter, E. J. Edgar, N. D. Edinborough (2nd Lieut.), E. Edminster, S. Ethelston (2nd Lieut.), L. E. Felix-Smith (2nd Lieut.), A. C. Fendick (2nd Lieut.), C. M. Fiander, A. H. Finnis, J. Fleming, L. G. Floyd (2nd Corp.), J. Forbes (Lance-Corp.), H. H. Foster, R. Fruhe-Sutcliffe (2nd Lieut.), J. M. Furnival (2nd Corp.), W. E. Gardner (2nd Lieut.), F. J. Gibson (Corp.), J. A. Gibson (2nd Lieut.), F. Goble, D. C. Goodwin (2nd Lieut.), E. Gordon, J. O. Griffiths, S. J. Grose (2nd Lieut.), S. Gudgeon (2nd Lieut.), H. J. Gwyther (Lieut.), H. C. Hannam-Clark (2nd Lieut.), L. G. Harris, R. W. Harrison, L. V. Hart (2nd Lieut.), G. Hartley, C. E. Hawkins, H. Headwards (Sergt.), A. D. Hedgecock, A. T. Hitch (Lieut.), J. E. Hogarth, H. S. Housden, A. Howarth (2nd Lieut.), C. G. Huntley, A. Hutt, Forbes Jackson (Sergt.), H. Y. V. Jackson, E. F. James (Corp.), E. G. James, V. A. Jones, W. A. Kennedy, W. W. Kerr, J. W. Kilby, C. S. Knight, J. M. Knight (2nd Lieut.), H. A. Krasemann, V. R. Krohn (2nd Lieut.), C. F. Lane, B. W. Leak, H. J. Lee, B. E. Leeson (Corp.), B. H. Leeson (Corp.), G. A. B. Leishman (2nd Lieut.), G. N. Le May, A. Lisle, W. H. Lovell, A. W. R. MacPherson (2nd Corp.), F. H. Mann, G. S. Marston (Corp.), G. E. Martin (2nd Lieut.), R. O. Martin (Sergt.), J. N. Metcalf, B. E. G. Mittell (Sergt.-Major), P. Morrell, C. I. Morris, J. Mould (2nd Lieut.), J. W. Mowat, S. E. Newman, G. R. Nichols (Lance-Corp.), W. H. J. Norburn (Lance-Corp.), S. B. North, J. A. Nunn (Corp.), B. S. Orme, P. Ostler, W. A. A. Page, A. D. Peacock, J. D. Beattie (Lance-Corp.), H. F. Pernet, J. F. Perrin (2nd Corp.), L. H. Peter (2nd Lieut.), R. C. Philipp (Lance-Corp.), H. H. Phillips, H. W. F. Ponter, C. A. W. Powell (2nd Corp.), H. G. Poynter (2nd Lieut.), G. R. D. Prince (2nd Lieut.), S. E. Pritt, E. L. M. Protheroe, R. N. L. Protheroe, W. W. Pullen, H. W. Puttick, S. M. Rawson (Corp.), D. Reeves-Smith (2nd Lieut.), R. E. Ricci (Senr. Wireless Officer, H.M. Hospital Ship, *Asturias*), W. Richardson, A. C. Roberts, J. N. Robertson (Sergt.), J. T. Rodwell, G. Ross-Bain (2nd Lieut.), P. J. Ryle, C. W. C. Sadler, C. Saxton, A. M. Scarle (Sergt.), C. G. Shaw, O. W. Sherwell (2nd Lieut.), E. J. Shuter, W. Sinclair, N. Sizer (2nd Lieut.), F. K. Skevington, E. W. Sleight, L. C. R. Smith (2nd Lieut.), L. W. Smith, R. H. Smith (2nd Lieut.), S. B.

Smith (Sub-Lieut.), S. Snowden (Lieut.), L. C. Speed, W. G. Spencer, J. H. Squire (Sergt.), G. H. Stade, R. Stafford, J. Steele (2nd Corp.), C. A. Stephens (Sergt.), E. Swinton (2nd Lieut.), A. R. Tabor (2nd Lieut.), K. B. Taylor (Capt.), E. Thomas, J. M. Thornton (2nd Lieut.), F. Troutet (French Army Engineers), D. G. Trouton (2nd Lieut.), C. H. J. Trutch (2nd Corp.), C. P. Tufnell, T. C. Turton, C. L. Underwood, G. J. Websdale (2nd Lieut.), H. B. Webster (2nd Lieut.), R. I. Wells, J. F. Weston, P. J. Wheeler (2nd Lieut.), T. P. Wilson, J. B. Windle (2nd Lieut.), D. S. Wood (Qmr.), P. J. Wood, H. Woodside, L. S. Wooler, T. G. Woolley (Lieut.), C. N. Young, and W. Young

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,426.

In a turbine-driven 25-kw. direct-current dynamo running at 5,000 r.p.m., it is observed, when running up, that there are several periods before the armature reaches top speed when undue vibration occurs. This vibration does not continue, but comes at intervals, whilst the machine is increasing in speed. What is the cause and remedy? In machines of this class, what is the best method of trueing commutators which are uneven due to wear?—R. W. S.

(Replies must be received not later than first post Jan. 28th.)

ANSWER TO No. 1,424.

Explain the method of calculating reactances with iron core and air return circuit, such as are used for feeder protection.—POSTULATOR.

An award of 10s. is given to "L. R." who says:—

The size of feeder reactances depends mainly on the capacity of the feeder compared with the generator or generators, and the breaking capacity of the feeder circuit-breaker. For example, if the feeder is rated at one-quarter the generator, a reactance of 3 per cent. in the feeder will pass no more current than a total reactance of 12 per cent. in the generator. (The value of the reactance is ordinarily referred to in terms of the percentage drop of voltage across its terminals with full-load current flowing.) In the case of several generators in parallel, the effect of the feeder reactances is proportionately increased, so that unless the total feeder rating is greatly in excess of the generator rating, the total kilowatt capacity of the feeder reactances may be less than that of the generator reactances, although the number may be much greater. In certain cases it is desirable to group the feeders and use one set of reactances for each group, but if the feeders are of very great capacity compared with the generators, the feeder reactances would be so great that their use might not be justified. Many current-limiting reactances have been designed without iron in the magnetic circuit, but practice now tends to the use of a magnetic circuit partly through iron and partly through air. The construction is practically the same as that of a transformer, and the value of the reactance can be worked out on the usual transformer calculations. The object of having some air in the circuit is to obtain a straight-line characteristic up to, say, 50 per cent. overload. The larger the capacity of a reactance coil and the lower the frequency, the less will be the advantage obtained by using iron in the magnetic circuit. Reactance as it will be understood is the difference between pL and $1/pK$, so that both inductance due to the number of turns and the current flowing has to be considered, and also capacity due to the effect of the metal coils in proximity to one another, forming an air condenser.

The usual formula on which the design is based is the ratio between the square of the number of turns, multiplied by the current multiplied by the area of the leakage path, and the length of the leakage path multiplied by the square of the number of groups, this whole ratio itself being multiplied by a constant depending on the frequency. Sometimes, to modify the value of the reactance, the turns are wound, not evenly, but in groups, which must be taken into consideration.

The effect of variation of frequency can be seen from the following table, which represents a reactance applied to two different frequencies:—

| | Frequency $62\frac{1}{2}$ | Frequency 25 |
|--|------------------------------|-----------------|
| Turns | ... | 34 |
| Reactance in ohms. | ... | 0.227 |
| Reactance per cent. | ... | 10.4 |
| Current in amperes | ... | 1750 |
| Ohmic resistance | ... | 0.00197 |
| Temperature rise full load for three hours | ... | 43.7°C. |
| | | 33°C. |

Thus it will be seen that by increasing the frequency from 25 to $62\frac{1}{2}$ the reactive value has increased from 4.2 per cent. to 10.4 per cent., and the temperature rise has increased by 10° C. In connection with the size of reactance to be employed, it should be remembered that a generator which will give but two or three times full-load current on sustained short circuit may give from 20 to 40 times the full-load current immediately it is short-circuited. If now the value of the reactance of the generator armature be 5 per cent., there may be a flow of 20 times the normal current on short-circuiting, and if reactance coils be added to give an additional 5 per cent. reactance, this instantaneous rush is limited to 10 times the normal value, but both these values may be very greatly increased in any given case, because the magnitude of the current will depend upon the point of the voltage wave at which the circuit is closed, seeing that when pressure is suddenly applied across the terminals of a choking coil it is now known that the instantaneous rush of current is greatly in excess of that ordinarily expected.

It may be useful to give the working out of a small reactance coil on transformer lines. Consider that the reactive E.M.F. of self-induction is to be 100 volts with 10 amperes at 60 cycles; that the coil has 200 turns of No. 8 B. & S. copper wire of 16 inches length mean turn; the magnetic circuit is 6 sq. ins. in section, 18 ins. mean length of iron of hysteresis co-efficient 2.5/1000. The air-gap section = 10 sq. ins. The resistance of the wire comes to 0.175 of an ohm.

Now $E=4.44 nSN/10^6$ (where n equals periodicity, and N = magnetic flux), whence $N=0.188$ megalines. This gives in an air gap of 10 sq. ins. a maximum density of 188,000 lines per sq. in., or 2920 per sq. cm.

Now 10 amperes in 200 turns = 2,000 effective ampere turns, or 2,830 maximum.

The air gap accounts for practically the whole of the ampere turns.

Now $B=4 \times 3.14 CS/10^6$, whence the length of air gap = 1.22 cm., or 0.48 in. With 6 sq. ins. section and 18 ins. mean length, the volume of iron is 180 cubic ins., or 1,770 cubic cms. The density in the iron = $1,880,000/6 = 313,000$ lines per sq. in., or 4,850 lines per sq. cm.

The loss per cycle is therefore $4,850 \times 2.5/1,000 = 2,220$ ergs., and the hysteretic loss at 60 cycles and 1,770 volume is, = 23.5 watts. At 10 amperes this represents an effective hysteretic resistance of 0.235 ohms. Thus the total effective resistance of the reactive coil which is that resistance added to the resistance of the wire = $0.235 + 0.175 = 0.41$ ohms. Now, writing the effective reactance as wattless E.M.F. divided by total current which is one way of representing it, this reactance is = 10 ohms, and the impedance in ohms. works out at 10.01, and the power factor at 4.1 per cent. The total volt amperes of the reactive coil come to 1,001, and the loss of power (C^2R) = 41.

For further information the following papers can be consulted: I.E.E. Journal, Vol. 52, pp. 254, 512, and 584; Transactions of the American Institution of Electrical Engineers, Vol. 30, p. 1143, and Vol. 31, p. 2015.

No other award is made.

ANSWER TO No. 1,421.

Mr. V. F. Bush writes us:—

"As there seems to be a suggestion that the apparatus described by me is of little practical value, let me state that it was given a thorough test on a large mains system before being sent to you as a solution to the problem. It was quite easy to distinguish between a live and dead cable with the apparatus described. From the wording of the question it was assumed that an H.T. feeder had been made dead in a known duct carrying other H.T. cables which were alive; my contention is that the cables carrying current will give a louder hum in the telephone than the cable which is dead. If there were several ducts and it was not known which one contained the dead cable, then there might be some uncertainty as to the dead cable, as the leakage flux from adjacent cables might give a hum in the telephone when tried over the dead cable, equal to the hum produced by the flux from a cable carrying a very small current. Had I to use the apparatus to any extent, and I had any doubt as to the result, I should, where possible, rearrange the load on the live feeders in question before commencing the test, so that no two cables were carrying the same amount of current; a little thought and trouble in this direction would save one from the unpleasant experience of cutting a live H.T. cable and incidentally save the expense of making the main good again. The triangular search coil is well known to most mains

engineers for the localisation of faults in armoured concentric mains laid direct in the ground, the coil picking up the leakage flux through several feet of earth, and for this reason it is very much too sensitive to be used in the solution of R. McC.'s problem. Regarding Mr. Freeman's remarks, I can only think that his apparatus was open circuited, or the telephone out of order. Of course, it is quite understood that this device will not work on continuous-current mains. I might mention that when stray flux becomes troublesome, if a sheet of soft iron is bent horseshoe shape round the apparatus it will prove effective in making the apparatus more 'selective' to the flux from the cable under test. I am quite sure that it only requires very little care to put the apparatus under discussion to intelligent use."

TEMPORARY GENERATING STATION OF THE BIRMINGHAM CORPORATION

WE referred briefly in ELECTRICAL ENGINEERING, Jan. 7th, p. 9, to the temporary generating station which the Birmingham Corporation have decided to put down to deal with the enormous applications for electric power that are coming in mainly from manufacturers of war material, pending the completion of the large new station at Nethells. The present plant will be sufficient for this winter, and the temporary station is to provide for the winter load of 1915-16. The permanent Nethells station is expected to be ready for the winter of 1916-17. The temporary plant will be of 10,000 kw. capacity, and will be put upon a site adjoining the Nethells works in a way that will not interrupt the contracts there now in hand. We have already detailed the estimated cost of the plant, amounting in all to some £97,000. The following plant has already been ordered:—Six marine-type water-tube boilers from Babcock & Wilcox, Ltd.; two 5,000-kw. turbo-alternators with condensers from the British Westinghouse Electric & Manufacturing Co., Ltd.; and five cooling towers from the Davenport Engineering Co. The rest of the plant for which contracts are yet to be placed comprises coal-conveyors, feed-pumps, piping and valves, switchgear, cables, &c. The cost of the temporary foundations and buildings is estimated at about £10,000, but all the plant with this exception will be incorporated into the Nethells station when the plant therein is sufficiently advanced to permit of its being released. In view of the extreme urgency, the work is being proceeded with, in anticipation of the sanction of the Local Government Board to the necessary loan.

THE LONDON COUNTY COUNCIL POWER SCHEME

AS the time for lodging petitions against private Bills in Parliament approaches, the opposition to the two London Electric Power Bills increases. Local authorities in all parts of the proposed area are passing resolutions in favour of opposition, and so far not one case of support has come to our knowledge.

We have already referred to the position taken up by the Marylebone and Hammersmith Councils. The report of the Electrical Engineer to the former has not yet been published. Mr. Sydney Baynes, the Borough Electrical Engineer at St. Pancras, however, in a report is unsparing with his condemnation of the L.C.C. scheme, which, he says, "presents the greatest display of inefficiency to guard public interests ever committed to print." The second Bill, proposing to incorporate a new company, is "a striking contrast to the L.C.C. Bill in clearness of intent and brevity of description, and is indicative of a businesslike conception of all the circumstances surrounding the complex questions dealt with." He adds that he is given to understand that already many of the London Companies have agreed to exchange their undertakings for London Electric Bonds, and in consequence the Company's Bill may be dropped at a fitting juncture.

The Poplar Borough Council is equally hostile, and agrees with St. Pancras that existing municipal electricity undertakers will find it almost impossible to carry on their undertakings should the L.C.C. Bill pass. Petitions are to be entered against both Bills.

Among other authorities which have decided to oppose are Paddington, Richmond, and Loughton. Conferences are being held by all the county authorities concerned. Already one has been held by the Middlesex County Council, and another is to be held at the instance of Surrey to-day. The Kent C.C. is also asked to convene a conference, and the whole attitude of the local authorities in the counties is one of strong opposition.

Institution Dinner.—The last issue of the *Journal of the Institution of Electrical Engineers* contains the official announcement that there will be no Annual Dinner this session.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 14th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

26,834/13. Wireless Telegraphy. P. O. PEDERSEN and V. POULSEN. A system of continuous-wave production, with a number of arcs in parallel, in which the distribution of high-pressure current is equalised by inserting one or more condensers connected to each arc in the main oscillation circuit in series with the main condenser. (Three figures.)

29,063/13. Regulation of Converting Plant. B.T.-H. Co. (G.E.C., U.S.A.). Automatic regulators to control the direction and magnitude of the interchange of energy between a continuous-current and an alternating-current system, coupled by a motor-generator, according to the relative loads on the two systems by varying the excitation of the continuous-current machine. (One figure.)

29,562/13. Small Motor. J. F. P. DE LA RIBOISIÈRE and R. LE GRAIN. Motors of specially compact two-pole fully-enclosed design for working sliding windows. (Two figures.)

29,902/13. Wireless Telegraphy. A. F. SYKES and S. FORD. A method of producing continuous oscillations by causing periodic variation in the resistance of a liquid rheostat. A disc provided with a large number of alternate conducting and non-conducting strips rotates rapidly opposite diametrically placed terminal plates immersed in a conducting liquid. (Three figures.)

8,062/14. Metallic Casing. R. McGEOCH. This casing is made from rolled sheet, and corrugations are stamped at each side for reception of the wires, while the centre is left flat to screw to the walls. Elbow and tee joints of special form are stamped from similar sheet. (Seven figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: STURGES, 5,050/14.

DYNAMOS, MOTORS, and TRANSFORMERS: B.T.-H. CO. and HASTINGS [Motor control] 30,083/13; Soc. ANON. LE CARBONE & GINDRE [Brush leads] 9,468/14.

IGNITION: MASON [Ignition system] 173/14 and 21,823/14.

SWITCHGEAR, FUSES, and FITTINGS: B.T.-H. CO. and HASTINGS [Switching systems] 391/14; LUCAS and EDWARDS [Switches] 3,011/14.

TELEPHONY and TELEGRAPHY: BETULANDER [Automatic telephones] 29,615/13; GALLETTI and GALLETTI'S WIRELESS TELEGRAPH & TELEPHONE CO. [Wireless transmission] 29,712/13; AITKEN and AITKEN [Semi-automatic telephones] 53/14; WESTERN ELECTRIC CO. (Woodward for W. E. CO., U.S.A.) [Impulse control system for automatic exchanges] 3,360/14; BETULANDER [Automatic telephone selectors] 18,076/14.

TRACTION: B.T.-H. CO. (G.E. CO., U.S.A.) [Train control] 29,752/13; WHITE (Sturges) [Electric railways] 10,948/14.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Mr. S. C. Burtholomew read an extremely useful Paper before the Institution of Post Office Electrical Engineers on December 21st. He reviewed our entire knowledge up to date of the problems arising out of the interference of electric power circuits (including railways) with telephone and telegraph lines, and besides giving the general principles upon which both lines should be laid out, he detailed the various methods which had been employed to minimise the disturbance. On ordinary power lines, much can be done in the suitable arrangements of the power circuits themselves. A case is on record in America in which a 140,000-volt line induced a potential of 2,300 volts in a neighbouring telephone line, which was reduced to between 20 and 30 volts on revolving the former. A serious electrostatic disturbance

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: LAMME [Running polyphase motors on single-phase circuits] 22,914/14.

INSTRUMENTS: H. ARON ELEKTRICITÄTS-ZAHLERFABRIK [Meters] 15,644/14; BLATHY [Meters] 24,543/14.

TRACTION: SOC. ANON. DES AUTOMOBILES ET CYCLES PEUGEOT [Car lighting] 23,873/14 and 23,917/14.

MISCELLANEOUS: BOUSSON [Mercury vapour lamps] 24,502/14.

Applications for Suspension of Patents

7,617/10. SPARKING PLUG. L. PONCSZUS (Berlin). The application made by J. H. Meyer, of London, for the suspension of the above Patent has been granted. It relates to a self-cleaning plug consisting of a hollow central electrode in conjunction with a cylindrical outer electrode. Air is drawn through the central electrode and is deflected so as to scour the ignition points, thus cooling and cleaning them thoroughly.

12,871/13. ELECTRIC IGNITION. W. RUTHARDT (Stuttgart). The application for suspension of this patent made by C. A. Vandervell and Co. has been granted. The Patent is for timing devices in magneto ignition gear in which the part carrying the contact to be displaced angularly is moved positively in one direction but tends to return in the other direction by the action of a helical spring lying in an annular groove in the movable part.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:-

1,347/01. TELEPHONY. J. E. KINGSBURY. A long specification with a number of claims describing a method of private branch exchange working.

The following are the more important Patents that have become void through non-payment of renewal fees.

DISTRIBUTING SYSTEMS, CABLES and WIRES, INSULATING MATERIALS, &c.: B.T.-H. CO. and E. B. WEDMORE [Feeder protection] 20,498/08.

DYNAMOS, MOTORS, and TRANSFORMERS: SIEMENS BROTHERS & CO., LTD., H. ALTMANN, and W. LAU [Armature coils] 21,460/07.

INCANDESCENT LAMPS: B.T.-H. CO. (G.E. CO., U.S.A.) [Heating metal filaments in nitrogen to increase their resistance by the formation of a nitride] 21,511/06.

Storage Batteries: H. W. VAN RADEN and C. B. ROBINSON [Spun glass battery plate separators] 21,472/06; H. W. VAN RADEN, C. B. ROBINSON, and M. METZ [Battery plates] 21,719/06; J. P. COOK and E. SOKAL [Battery plates] 21,646/07; VAN RADEN & CO., C. B. ROBINSON, and M. METZ [Battery plates] 2,728/08.

SWITCHGEAR, FUSES, and FITTINGS: T. G. HOWE & F. H. TAYLOR [Switch-plugs] 22,385/09.

TRACTION: H. PIEPER [Petrol-electric vehicles with independent drive for the two driving wheels] 23,172/05; J. W. TAYLOR [Brake and collecting shoes] 20,472/08; SIEMENS BROTHERS & CO., LTD., and M. G. FERRIERA [Railway signalling] 20,601/08.

MISCELLANEOUS: H. C. HUBBELL [Miners' lamps] 21,675/06; M. HANKIN & F. WOLFF [Powder resistances] 20,352/08; E. B. COUSANS [Organ blowing] 22,258/09; F. ECKERSLEY and W. CRESWICK [Electric coal cutters] 22,432/09.

can also be produced by the third harmonic currents in the case of lines connected to earthed star transformers, as these currents are then identical in direction in all three lines. On tramway lines, although the current is D.C., electromagnetic disturbances have been occasioned, due to the currents from rotaries not being perfectly continuous; the effect is not simply produced by a "ripple" apparently, but by a more complex pulsation which has not been completely investigated. The tramway motor's themselves also cause irregularities, and the author suggests the addition of a choke coil on each car. Methods of arranging single-wire telephone circuits (where these are still in use) to minimise the trouble were also gone into. Single-phase railways afford the most difficult and at the same time the most interesting problem. Intermediate earthed wires as a shield are only partially effective, and the same applies to the Scott method, in which an auxiliary telegraph wire is interposed with a transformer in it, the secondaries of which are connected in the actual telegraph and telephone circuits. Recent modifications of these neutralising transformer systems, however, have been said to have had a very satisfactory effect on some American

lines. A very pretty method is also the "resonant shunt" method, in which a capacity and inductance, dimensioned to be in resonance with the railway frequency, is bridged across the telegraph line. This shunt, however, has itself necessarily a prejudicial effect on the working of telegraph lines at certain speeds; tests made on the L.B. & S.C. Railway showed that "A.B.C." working was impossible, as was also Wheatstone working above certain speeds, so that it can only be deemed a cure at hand speeds. The Paper is an exceedingly valuable one, and we trust that it will be reprinted in *extenso* and issued at an early date.

Some notes on the German airship wireless service are contained in the *Wireless World*. Wireless stations are established at all the German frontier airship stations, forming a continuous chain thirty-three in number all round the country. Few of these stations appear in the official lists, and it is possible that some are of a temporary nature. According to a map given in our contemporary, those on the western frontier are at Cuxhaven, Emden, Rheine, Kempen, St. Vith, Metz, Strassburg, and Mülhausen. With regard to the equipment on the Zeppelins, trials of the *Viktoria Luise* passenger airship in 1913 established continuous communication up to 200 miles, and the sets on the new war craft are said to be more powerful. The aerial consists of a 3-mm. phosphor-bronze wire unwound from a reel to any length up to 750 ft. and allowed to hang down free in the air. The apparatus itself is very compact, and the dynamo is driven off one of the main engines. The weight complete is 150 lb., and wave-lengths from 300 to 1,200 metres can be used. Elaborate precautions are taken to guard against ignition of leaking gas by sparks.

Lieut. A. A. Jane, R.E., "with the Expeditionary Force," has contributed a well-written Article to the January number of the *Telegraph and Telephone Journal*. Formerly, he says, the service in the Army was carried out by the following branches working more or less separately: (a) Telegraphy and telephony, by the Royal Engineers; (b) Visual signalling, by regimental and battalion signallers; (c) Orderlies; and (d) Postal Service. The first three branches have now been combined into what is called the "Army Signal Service." The Army Postal Service remains a separate organisation, but it works in co-operation with the Army Signal Service. The Army Signal Service units are made up as follows:—The signal squadron carries out inter-communications between Cavalry Divisional Headquarters and Cavalry Brigades. It also keeps in touch with General Headquarters by wireless telegraphy. Signal troops carry out inter-communication within Brigades, with Cavalry Divisions or General Headquarters, as may be necessary. Signal companies with Divisions are intended for inter-communication. Finally, air line, cable, and wireless companies carry out inter-communication between General or Army Headquarters and lines of communication. On such lines as between General Headquarters and the advanced bases, Wheatstone automatic is largely used; and for the forward lines connecting General Headquarters with the various Armies, ordinary double-current sounder duplex. From General Headquarters to Cavalry Divisions aerial lines are used for a portion of the way, and for the remainder cable. At present the Cavalry Corps is connected by cable to an intermediate transmitting centre, and vibrators are in use. Wireless also connects the Cavalry Corps with Headquarters. Cable and dispatch riders connect the Divisions with their respective Corps Headquarters. Field air line can be erected at the rate of about five miles a day by a small detachment of non-commissioned officers and men. An insulated field cable can be laid on the ground at the rate of about four miles an hour. The arrangements of the military telegraph rooms in war time are not so rough-and-ready as many people would imagine. Everything in use is designed for the purposes of dismantling and setting up again at a moment's notice, but order prevails throughout. For instance, the double-current Wheatstone duplex sets are now being placed on a baseboard, so that the apparatus can be moved *en bloc*, with the internal wiring intact, and similar arrangements are made in regard to the other apparatus; recently an order given for the removal of the "Central Telegraph Office of the British Army" from one building to another was actually executed within twenty-four hours, without severing a communication. It is difficult to recognise telegraphists during war time, for when they parade for duty they look as good and as keen soldiers as one would wish to meet. They are drawn from T.S., the London Postal District, and from Provincial Offices, and while excellent soldiers, they are no less expert telegraphists. They take their business seriously, and their ready response to all calls made upon them reflects credit on both Services. When business is brisk in the firing lines the wires leading

to them are correspondingly busy. There are no slack periods, for as soon as the "business" houses are closed in the field, the offices at the various bases commence work. Then lengthy indent messages on ordnance and other supplies begin to come in, and Wheatstone working is resorted to. Pressure continues up to 5 a.m., when there is a slight lull for a short time. Then first one and then another circuit "wakes up," and that is the sign that the activities for the day "farther up" have commenced.

Considerable improvements are being made in the telephone service between London and Brighton. An underground cable at a cost of about £100,000 is expected to be completed in three or four months. Hitherto there has been much interference owing to the overhead wires failing through storms. It is the intention to extend this direct telephonic communication with London to other South Coast towns between Brighton and Portsmouth.

ELECTRIC TRACTION NOTES

It is interesting to note from the *Electric Railway Journal* (New York) that the use of the mercury rectifier for heavy traction purposes is now an accomplished fact. A Westinghouse equipment intended for a locomotive for running off an 11,000-volt single-phase line with four D.C. 1,000-h.p. motors is now running on a branch line of the New York, New Haven & Hartford Railway, and has already covered over 20,000 miles. The high-tension is led into a transformer, the secondary of which is provided with a centre tap and with a number of others equally spaced two by two from the centre on both sides to permit the varying of the A.C. voltage from zero to the maximum. The centre tap connects with the terminal of a group of four 600-volt motors connected permanently in series-parallel. The group is earthed at the centre. The outside secondary transformer terminals connect to the two positive electrodes at the top of the rectifier. The remaining connection is from the mercury or negative terminal of the rectifier to the other terminal of the motor group. The rectifier consists of a light steel cylinder container approximately of 20-in. diameter and 36-in. height. The electrodes enter at the top of the container through air-tight insulating bushings, projecting a short distance into the cylinder. The arc is started by means of a small motor-generator exciter. No external reactance is needed on the D.C. side, as the motors furnish ample reactance for the purpose of steadyng the current. The voltage-drop in the rectifier is about 25 volts.

Modern Electric Lighting.—A Paper with this title was read by Mr. H. C. Wheat at a recent meeting of the Rugby Engineering Society. The author pointed out the great possibilities that were opened up by the use of metal filament lamps in conjunction with suitable reflectors to direct the light where it was wanted, and explained the main principles of illumination and the action of light on the eye, emphasising the harmful effects of glare due to the high intrinsic brilliancy of modern illuminants, and the necessity for adequate diffusion. The principle requirements were that the lamps should be equipped with some form of reflector or diffuser, to re-direct the light where required; this reflector should also act as a shade to protect the eye from the naked filament, or, if a diffuser, it should reduce the intrinsic brilliancy to an agreeable value. Any reflector employed should have a surface as large as practicable, and of such a nature as to avoid striations. For general lighting the lamps should be placed high, to remove them from the line of vision to secure more natural and agreeable effects, and to foreshorten the shadows. He described several commercial forms of reflecting shades, and passed on to describe the measurement of illumination and candle-power. A most important factor in determining the illumination produced in a room was the colour of the walls and ceiling, which determined the amount of light reflected. In conclusion, the differences between the direct, diffused, indirect, and semi-indirect systems of lighting were explained, and the advantages of indirect lighting when carried out with suitable reflectors were insisted upon.

The Central.—The December issue of this magazine of the old students of the City and Guilds (Engineering) College contains among other articles one by Mr. Percy Good on the efficiency of radiators. Polar curves of the distribution of radiation as measured by a thermopile are given, and the total hemispherical output of radiant heat deduced. The red-hot fire type of radiator was found to have a better efficiency than the lamp type, but the lamp radiator as shown by time curves, heated up much quicker than the "fire." Another article describes a new pattern of induction coil designed by Mr. W. H. Wilson. There are also many interesting notes as to the doings of old "Centralians."

"ELECTRICAL ENGINEERING" TRADE SECTION

CATALOGUES, PAMPHLETS, &c., RECEIVED

CEILING ROSES.—A new list of ceiling roses has been issued by A. P. Lundberg & Sons (477 to 489 Liverpool Road, N.), which contains a very large number of designs, including the "biflex, triflex, quadriflex, and multiflex" patterns, with two, three, four, and more contact plates respectively separated by porcelain partitions. Of the special roses, a very convenient arrangement is the detachable rose in which the flex is connected to two-pin plug, enclosed by the ordinary cover, which can be removed when desired to disconnect the fitting without disturbing the wiring in any way. Another special device is a combined ceiling rose and plug socket. The uses to which all the varieties of roses can be put are very fully explained in the list.

MOTOR HIRING.—A card from Electro-Motor Hiring, Ltd. (Green Mount, Pellon Lane, Halifax), calls attention to the motor hire-purchase system initiated by this firm.

STAGE LIGHTING.—A number of forms of stage arc lamps, ordinary flame arc lamps, bunch lights, stage plugs, dimmers, battens, and other fittings for theatre lighting, are dealt with in a comprehensive list devoted to this class of apparatus from Austin Walters & Son (57 Lower Mosley Street, Manchester), who have also sent us a copy of their list of electric signs.

OSRAM LAMPS.—A very pretty bookmarker from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) asks us to enjoy our reading with an Osram lamp.

HAND LAMPS.—A leaflet from the General Electric Co. lists a number of patterns of torches, pocket lamps, and hand lamps with dry batteries, and a bed reading lamp mounted on a bracket, to be strapped to the bed-post.

CALENDARS, &c.

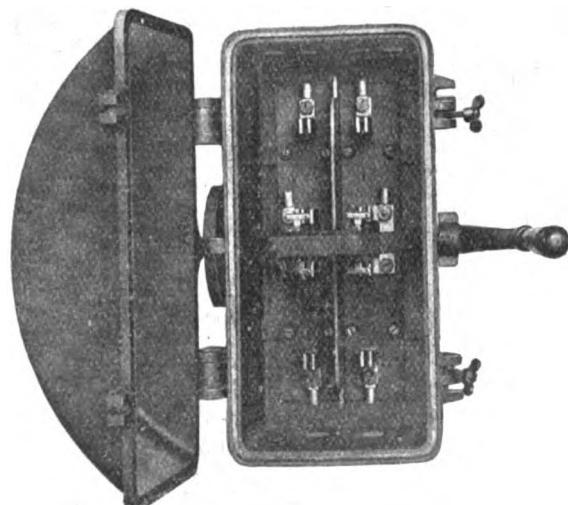
A neat little brass table calendar with daily cards for an office table has been sent us by the Edison & Swan United Light Co., Ltd. (Ponders End, Middlesex, and 125 Queen Victoria Street, E.C.).

A patriotic wall calendar decorated with a Union Jack is being sent out by Motor Hiring, Ltd. (Green Mount, Pellon Lane, Halifax).

A neat little pocket calendar, serving also as an inch and millimetre scale, is being distributed by the Key Engineering Co. (4 Queen Victoria Street, E.C.).

IRONCLAD CHANGE-OVER SWITCHES

ONE of the latest additions to the range of ironclad mistake-proof switchgear which is being developed by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, E.C.), is the change-over switch



"WITTON" IRONCLAD INTERLOCKED CHANGE-OVER SWITCH.

illustrated here, which is primarily intended for use in cinematograph theatres for changing over rapidly from one lantern to the other. It is equipped with an interlock which renders it impossible for the cover to be open whilst the switch is in the "on" position, or for the switch to be closed

whilst the cover is open, and, in accordance with L.C.C. requirements, the hinge does not carry current, so that the blade is dead when the switch is off. The break also complies with the Glasgow Corporation rules. Every facility for wiring is provided, and the cables are laid straight into the sweating sockets, which are placed exactly opposite the bushed inlet holes.

THE COOLIDGE RÖNTGEN RAY TUBE

THE Röntgen ray tube with heated tungsten cathode which has been developed in America by Dr. W. Coolidge is now on the market in this country, and an interesting pamphlet thereon has been issued by the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.). This tube has the great advantage that the character of the rays emitted does not depend upon the degree of vacuum. The vacuum is made permanently as perfect as possible, and the cathode is electrically heated to a point where it throws off electrons when the tube becomes conductive and is used in the ordinary way. A view of the complete tube is shown in Fig. 1, and the details of the electrodes are shown enlarged in Fig. 2. The heated tungsten

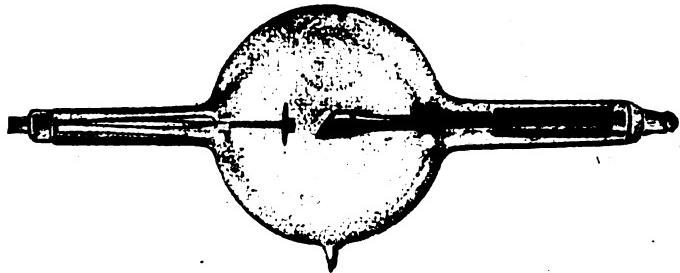


FIG. 1.—COOLIDGE RÖNTGEN RAY TUBE.

coil (1) forms the centre of the cathode, and is surrounded by a tungsten tube, 11, which has a focussing action and causes the cathode rays to infringe upon a definite spot on the tungsten target, 15. The use of a hot cathode greatly changed the characteristics of the tube, doing away entirely with puncturing troubles, with movement of the focal spot, local heating, and fluorescence of the active hemisphere, and with the emission of troublesome X-rays from the glass. The discharge current carried by the tube when a definite potential is impressed upon the terminals may be increased or decreased at will, and with it the intensity of the X-rays produced, as these depend only on the temperature of the heated portion of the cathode. The penetration of the X-rays produced may be instantly increased or decreased at will by raising or lowering the

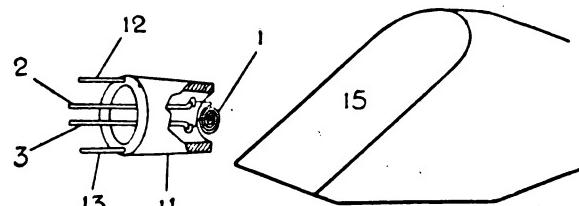


FIG. 2.—ENLARGED VIEW OF ELECTRODES.

potential difference impressed upon the tube. Thus not only is a large amount of adjustment eliminated, but a single tube can be used to do a variety of work requiring rays of greatly differing penetrative power. Exact duplication of results is possible, and the tube has a stability, fixity of focal point, life, and power unapproached by older patterns.

The "hardness" of the rays is varied by regulating the current through the tungsten filament, which is supplied by a small insulated local storage battery. We understand that a number of these tubes are in use at the hospitals at the Front, and there are hopes that the rays of great penetration produced may enable the tube to replace the use of radium in certain therapeutic work. Owing to the rectifying action of the tube, either alternating or continuous current can be employed.

MARINE TELEPHONES

A SERIES of special designs of loud-speaking telephones for shipboard work has been standardised by Siemens Brothers & Co., Ltd. (Woolwich), and the latest patterns are described in an illustrated catalogue which has just been issued. In this form of telephone the loudness of speech is not obtained by passing a heavy current through the microphone, but by a special system of connections which requires only a current of about 0·07 amp. in the microphone. The transmitter at one station is in series with the receiver at the other station, and the transmitter at the second station in series with the receiver at the first station, with a common



MARINE LOUD-SPEAKING TELEPHONE.
MERCHANT SERVICE PATTERN.

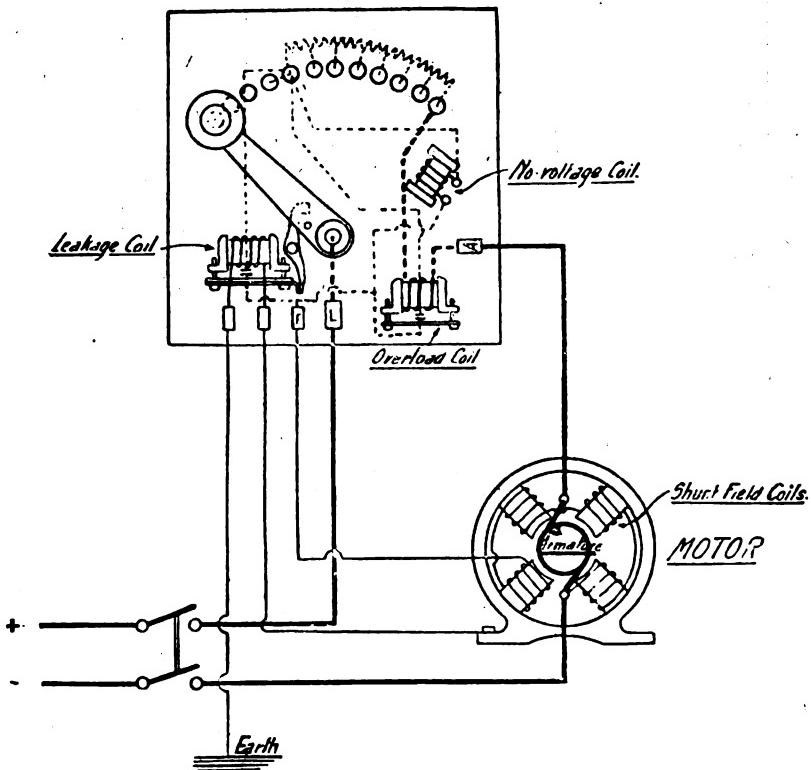
line for return. The source of supply is inserted as a bridge between the common return and the two lines connecting the transmitters and receivers through small inductances, which prevent the speaking current from passing, but allow the microphone feeding currents to pass readily. Hence, fluctuations of the current due to the action of the transmitters pass directly through the receiver without passing through the source of supply. This increases the clearness of speech and also the loudness with a smaller current flowing. The microphone is perfectly watertight in a capsule form, this being made possible by using a diaphragm of metal instead of carbon, as is usual. The watertightness of the microphone is very important, as the slightest moisture on the carbon granules impedes their action and prevents clear speaking. The capsules are also enclosed in the watertight case of the instrument, but should the lid of the case by accident be left not watertight, the essential parts of the telephones are not thereby damaged. The instruments are arranged for working off a 15-volt circuit, but will work quite satisfactorily on circuits with pressures between 12 and 20 volts. The necessary current for working can be obtained either from the ship's lighting mains by means of a potentiometer resistance, or by primary or secondary batteries.

The special naval patterns include a side-tube type somewhat similar to that illustrated, fire control and cabin types, with hand combination sets, and a headgear and breastplate set. A metal-cased design of exchange board is made for use with these instruments.

There are also a number of patterns to meet the requirements of the merchant service, including the side-tube instrument shown above. These and other patterns can be conveniently mounted in pillars or cases for attachment to bulkheads, and a strong ironclad selector switch-box can be used to provide a complete intercommunication system.

LEAKAGE PROTECTION FOR MOTORS

IT is possible for a small motor breaking down to earth to bring out the main circuit-breaker which is supplying the whole group of motors, and thereby to cause a complete shut-down of a large portion of a works. A device which precludes such an undesirable contingency can be fitted by the General Electric Co., Ltd (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.) to their standard continuous-current motor-starters. Using this device the motor is completely insulated from earth, except through the usual earthing conductor, in series, with which is inserted a low-resistance trip coil. When a leakage occurs to earth the current flowing through this trip coil actuates a



THE JOWERS LEAKAGE PROTECTION SYSTEM FOR MOTORS.

mechanism which short-circuits the no-volt coil if the motor be running, and trips the starter, thereby shutting down the motor. Alternatively, if the motor be standing, the leakage current actuates a catch, which holds back the starter arm if an attempt be made to run the motor up. The connections for this device are shown above. The addition of the coil to a "Witton" starter introduces practically no complications.

CORRESPONDENCE

REDUCED STREET LIGHTING.

To the Editor of ELECTRICAL ENGINEERING.

SIR.—We have seen the illustration and description of a reflector in your issue of Dec. 31st, which is claimed to be an innovation, inasmuch as it is designed to eliminate upward rays and give wide distribution of light on the ground. We would like to point out that there is nothing new in this, we having used this principle for a long time now, and we enclose

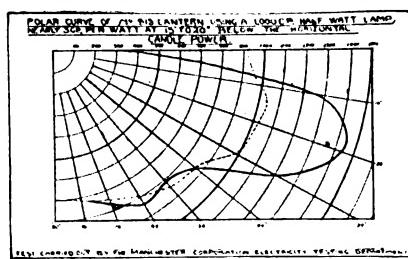


FIG. 1.

herewith an illustration (Fig. 2) of our No. 515 Primus lantern, from which will be seen that the filament does not project below the bottom of the internal reflector. The polar curve (Fig. 1) taken by the Manchester Corporation Testing Department, shows an increase of nearly 50 per cent. of the candle-



Just as an English oak laughs at storms, so do I withstand jolts and jars. A heart of oak is good—a filament of drawn tungsten wire is good—there you have the reasons why both of us are strong. That drawn wire filament was a great idea; it said "Never more" to weak lamps. Yes! I'm Mazda—the original drawn wire lamp—the development work took place in my glass bulb and the first drawn wire lamps put on the market bore my name. Mine is the kind of strength users want. If you sell lamps, sell me; if you use lamps, you have some lamp-holders I should be in. I'm Mazda.

The British Thomson-Houston Co., Ltd.,
Mazda House, 77, Upper Thames St., London, E.C.
Branches: Manchester, Birmingham, Leeds, Sheffield, Newcastle,
Middlesbrough, Glasgow, Swansea, Cardiff and Dublin.

Mazda
DRAWN
WIRE
LAMPS

BRITISH MADE IN
RUGBY, ENGLAND.

power at 17° below the horizontal, which is a far more useful ray for street lighting purposes than the 30° shown in the curve in your issue of Dec. 31st. For instance, if the height of the lantern is 25 ft., the 17° ray will reach a radius of 80 ft., whereas the 30° ray will only reach a radius of 44 ft. To

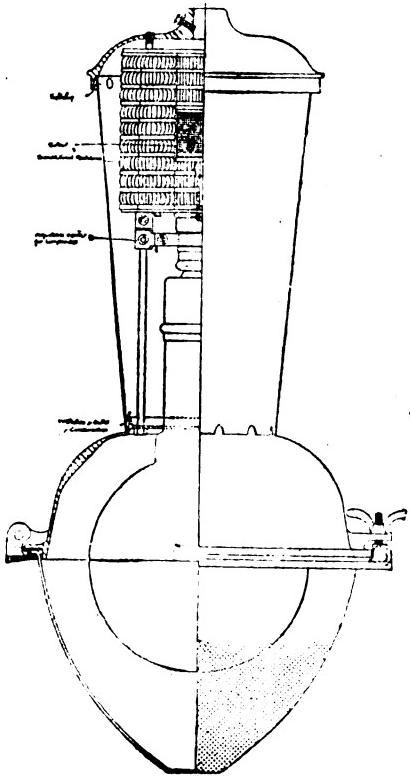


FIG. 2.

obtain even illumination it is very important to get the maximum candle-power very near to the horizontal, but this is very difficult if upward rays and glare are to be eliminated.

Yours faithfully,

THE WARDLE ENGINEERING CO., LTD.,
196 Deansgate, Manchester.
Jan. 11th, 1915.

AN AMUSING MISTAKE

A RATHER amusing incident occurred on Sunday last at the Ediswan Works, Ponders End. Mr. W. Deeley, one of the staff, was asked by the Advertising Department to take a photograph of the new glasshouse which has just been erected. He chose Sunday, doubtless thinking the better the day the better the deed; and in order to get a good view, crossed the river and was proceeding to get his picture from



the river-bank. Another employee being keen on spies, having just been training his eye on the Ediswan rifle range, spotted what he thought was a "spy" photographing the works. Fearing to fire in case of aiming straight, he decided to inform the police by telephone. Within two minutes a sergeant on a bicycle came speeding along the river-bank, and placed the "spy" under arrest pending reinforcements,

which arrived in the shape of a constable, also on a bicycle. The "spy," seeing that resistance was futile, asked his captors to accompany him across the river in the ferry boat, where, upon landing, they were met by the foreman of the glass-houses, who enjoyed the situation he found his colleague in. However, after identification, the prisoner was released, and an *entente cordiale* was formed, which is illustrated here.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Melbourne, Brunswick & Coburg Tramways Trust requires sub-station equipment, three-core H.T. cable, as well as tramway line material.—The Prahran & Malvern Tramways Trust (Melbourne) requires a booster and switchgear.—Specifications and forms of tender in both cases at 73 Basinghall Street, E.C.

Barrow-in-Furness.—The Borough Electrical Engineer has reported that it will be necessary, at an early date, to consider further extensions.

Beebles.—An electric lighting scheme is under discussion.

Beckenham.—A 120-kw. generating set and switchgear. Borough Electrical Engineer. Jan. 25th.

Blackrock.—A L.G.B. inquiry is to be held concerning a loan for the electric light scheme. Messrs. May & Hawes are the consulting engineers.

Bolton.—A new sub-station is to be erected at Bradshawgate.

Dundee.—A 15-ton overhead travelling crane for the Walton sub-station. Chief Electrical Engineer.

Greenock.—A loan of £30,000 has been granted for electrical extensions.

Harrogate.—Loans of £600 for services and £500 for transformers are to be applied for.

Hove.—The Borough Electrical Engineer recommends the installation of a 500-kw. steam turbine, with switchgear; a 115-cell battery and two battery boosters. He also recommends the fitting of superheaters to the existing boilers. The estimated cost is £6,970.

Redditch.—Two 1,000-kw. turbo-alternators with condensers, cooling tower, &c., and two synchronous motor-alternators (300 and 150 kw. respectively). Consulting Engineers, Handcock & Dykes, 11 Victoria Street, S.W.

Spain.—The list of goods required by the Spanish Government Departments, and in the supply of which foreign competition will be permitted during 1915, includes generating plant, lamps, searchlights, measuring instruments, laboratory apparatus, and submarine cables. The full list may be seen at 73 Basinghall Street, E.C.

Truro.—A loan of £10,000 in connection with the Council's electric lighting scheme is to be applied for.

Wiring

Warrington.—Electric lighting and bell installation, Oakwood Avenue Council School. Secretary, Education Offices.

Whitstable.—Workhouse.

Miscellaneous

Cardiff.—An expenditure of £7,000 is to be incurred upon doubling certain tramway tracks.

Halifax.—General supplies for Electricity Department. Borough Electrical Engineer. Feb. 15th.

Leeds.—General supplies for Electricity Department. Manager. Feb. 20th.

Worsley.—Extensions are to be carried out to the street lighting.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London: Bethnal Green.—The following tenders for cable in connection with the supply to be taken from the Stepney Borough Council have been received:—British Insulated & Helsby Cables, £12,498 14s.; W. T. Henley's Telegraph Works Co., £12,586 5s.; Johnson & Phillips, £12,618 9s.; Siemens Bros. & Co., £12,661; Western Electric Co., £12,734 5s.; Cal-

lender's Cable & Construction Co., £12,887; W. T. Glover & Co., £12,942 15s.; and the Union Cable Co., £12,948 11s. The first-named tender is recommended for acceptance subject to the sanction of the L.G.B. to the necessary loan. The Council has also accepted the tender of the Westinghouse Co. for static transformers and sub-station switchgear. Mr. H. W. Couzens is the consulting electrical engineer.

APPOINTMENTS AND PERSONAL NOTES

Messrs. Preece, Cardew & Snell, consulting engineers (3 Queen Anne's Gate, S.W.), are taking into partnership Mr. J. H. Rider, who is retiring from his position of consulting electrical engineer to the Central Mining and Investment Corporation, Ltd. (Johannesburg). The partners will then be Mr. A. H. Preece, Sir John Snell, Mr. Llewellyn Preece, Mr. J. H. Rider, Mr. J. H. Woodward, and Mr. S. S. Moore Ede. The firm will be known as Preece, Cardew, Snell & Rider.

Mr. J. Collinge has been appointed Station Superintendent at the Salford Electricity Works.

Mr. John A. Parker, Chief Assistant at the Greenock Electricity Works, has been appointed Chief Assistant at the Croydon Electricity Works. There were 187 applicants.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £64 5s. to £64 15s. (last week, £63 10s. to £64).

Australian Agency.—An Australian firm already representing several British manufacturers wishes to take up agencies for dynamos and motors, electrical accessories, cables and flexible wire, &c. Further particulars at 73 Basinghall Street, E.C.

Liquidations.—The Helsby Wireless Telegraph Co. is to be wound up voluntarily. Mr. J. B. Edwards, 25 Victoria Street, London, S.W., is liquidator. A meeting of creditors will be held on Jan. 23rd at the offices of Messrs. Kenneth Brown, Baker, Baker & Co., Lennox House, Norfolk Street, W.C., at 12 noon.

Mr. G. E. Corfield has been appointed liquidator (with a committee of inspection) of the Leitner Electrical Co., Ltd.

LOCAL NOTES

Bath: Diesel Engine.—It is recommended by the Electric Lighting Committee that Messrs. Mirrlees, Bickerton & Day inspect the Diesel engine and report as to the cost of altering it. The fee for this is to be 20 guineas, on the understanding that if the Council places the contract with the Company no charge will be made.

Edinburgh: Electric Wiring.—Notwithstanding the reputation of electrical contractors, referred to on p. 3 of our issue for Jan. 7th, a few verbal alterations only are proposed. These are to be submitted to the trade, and the clauses will be again considered at another meeting.

Luton: Delayed Plant.—A number of firms in Luton who are working on urgent War Office contracts are complaining of inability to obtain the necessary supply of electricity. Mr. W. H. Cooke, the Borough Electrical Engineer, states that he has been quite unable to obtain delivery of plant ordered more than twelve months ago, as the makers are too busy upon Government work themselves. The War Office, in August, facilitated the delivery of the turbines and water-tube boilers by allowing them to be consigned as military stores, but a similar permission with regard to other materials, including coal, was not granted. As the War Office has drawn the attention of the Corporation to the effect of the delay in the supply of current, the Borough Electrical Engineer suggests that pressure should be brought

to bear upon the makers of the missing plant by the War Office in order to facilitate delivery.

Sheffield: Showroom Opposition.—The local electrical contractors took the opportunity afforded by a L.G.B. inquiry on Saturday concerning a loan for new offices and electricity showrooms to oppose on the general question of the Municipal Sales Department. The Corporation claimed to have the power to erect showrooms, but the inquiry was necessary as it is proposed also to erect shops for letting in order to fill up the available land. The local contractors were represented by counsel, who contended that the Corporation is not entitled to run a showroom, and that the existing premises in Commercial Street are large enough if the showroom was done away with. The Inspector said he could hardly agree, and expressed the opinion that the existing accommodation was rather "poky" for a place like Sheffield. It was intimated that proceedings are to be taken by the contractors against the Corporation on the question of the Sales Department.

Institution of Electrical Engineers.—The following is the result of the ballot for new members, and the transfer of members from one class to another at the meeting last Thursday:—
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lender's Cable & Construction Co., £12,887; W. T. Glover & Co., £12,942 15s.; and the Union Cable Co., £12,948 11s. The first-named tender is recommended for acceptance subject to the sanction of the L.G.B. to the necessary loan. The Council has also accepted the tender of the Westinghouse Co. for static transformers and sub-station switchgear. Mr. H. W. Couzens is the consulting electrical engineer.

APPOINTMENTS AND PERSONAL NOTES

Messrs. Preece, Cardew & Snell, consulting engineers (3 Queen Anne's Gate, S.W.), are taking into partnership Mr. J. H. Rider, who is retiring from his position of consulting electrical engineer to the Central Mining and Investment Corporation, Ltd. (Johannesburg). The partners will then be Mr. A. H. Preece, Sir John Snell, Mr. Llewellyn Preece, Mr. J. H. Rider, Mr. J. H. Woodward, and Mr. S. S. Moore Ede. The firm will be known as Preece, Cardew, Snell & Rider.

Mr. J. Collinge has been appointed Station Superintendent at the Salford Electricity Works.

Mr. John A. Parker, Chief Assistant at the Greenock Electricity Works, has been appointed Chief Assistant at the Croydon Electricity Works. There were 187 applicants.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £64 5s. to £64 15s. (last week, £63 10s. to £64).

Australian Agency.—An Australian firm already representing several British manufacturers wishes to take up agencies for dynamos and motors, electrical accessories, cables and flexible wire, &c. Further particulars at 73 Basinghall Street, E.C.

Liquidations.—The Helsby Wireless Telegraph Co. is to be wound up voluntarily. Mr. J. B. Edwards, 25 Victoria Street, London, S.W., is liquidator. A meeting of creditors will be held on Jan. 23rd at the offices of Messrs. Kenneth Brown, Baker, Baker & Co., Lennox House, Norfolk Street, W.C., at 12 noon.

Mr. G. E. Corfield has been appointed liquidator (with a committee of inspection) of the Leitner Electrical Co., Ltd.

LOCAL NOTES

Bath: Diesel Engine.—It is recommended by the Electric Lighting Committee that Messrs. Mirrlees, Bickerton & Day inspect the Diesel engine and report as to the cost of altering it. The fee for this is to be 20 guineas, on the understanding that if the Council places the contract with the Company no charge will be made.

Edinburgh: Electric Wiring.—Notwithstanding the deputation of electrical contractors, referred to on p. 3 of our issue for Jan. 7th, a few verbal alterations only are proposed. These are to be submitted to the trade, and the clauses will be again considered at another meeting.

Luton: Delayed Plant.—A number of firms in Luton who are working on urgent War Office contracts are complaining of inability to obtain the necessary supply of electricity. Mr. W. H. Cooke, the Borough Electrical Engineer, states that he has been quite unable to obtain delivery of plant ordered more than twelve months ago, as the makers are too busy upon Government work themselves. The War Office, in August, facilitated the delivery of the turbines and water-tube boilers by allowing them to be consigned as military stores, but a similar permission with regard to other materials, including coal, was not granted. As the War Office has drawn the attention of the Corporation to the effect of the delay in the supply of current, the Borough Electrical Engineer suggests that pressure should be brought

to bear upon the makers of the missing plant by the War Office in order to facilitate delivery.

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COAL

THE question of the supply of coal to electricity works has become serious. We refer not to the price of coal (which, it is true, has risen very seriously), but to the actual question of obtaining coal in sufficient quantities to keep the electricity works going and the electric lighting continuous. Some of the electricity works have already been very nearly at the end of their stocks, some actually, with only 3 or 4 days' stock in hand, have been living from hand to mouth. Those with a fortnight's supply are considered to be in a comfortable position.

The works experiencing the greatest difficulty are those which are arranged to receive sea-borne coal only. Many colliers have, of course, been requisitioned by the Admiralty, and there is also great delay owing to the fact that in certain places the colliers are not allowed to be loaded during night. Many also usually anchor at night so that the actual voyage takes longer. We learn that the Admiralty has already agreed to release fourteen of the interned foreign ships specifically for coal traffic to London, but this will only slightly ameliorate the situation. Those electricity works which are arranged for receiving both sea-borne and rail-borne coal have been obliged to fall back on the latter; one London company, for instance, which customarily is provided with coal by water, has been supplied by rail only during the last two and a half months.

The position with regard to supplies by rail, however, is only slightly better, and great trouble is being experienced in getting supplies. Some collieries are only working two or three days a week because they cannot get the coal trucks, and refuse to mine the coal until these are available, for this means dumping the coal on the ground, and in consequence double handling. The railways have instructions from the military authorities to hold definite large quantities of rolling stock and also siding accommodation in reserve, a large amount of the coal for the Fleet has to travel partly by rail, and the labour available at the railway yards is not sufficient. All these things are holding up coal which in the ordinary course would have been in London weeks ago.

We are simply stating facts. While there is no need for any panic, it should be clearly understood that the position is a serious and a difficult one. The authorities, especially the Railway Executive Committee, are, we understand, doing their best to cope with the situation, and we recommend any of our central station readers who are in difficulties as to coal supply to appeal directly to them; the address is 35 Parliament Street, Westminster. Large demands are now being made on the railways by the military authorities, and will presumably be continued to be made for some weeks, so that the Committee will probably be assisted rather than harassed if electricity supply stations keep them well informed in good time of their needs and of the details of the difficulties they have to contend with.

ZEPPELINS AND LIGHT

A REPORT has been freely circulated, but based only on a surmise, that the electricity works in London had had instructions that all lights—both private and public—were to be switched off on the instructions of the Admiralty at the approach of hostile aircraft to the metropolis. We are in a position to state that this report is absolutely without foundation. When the Zeppelins and the German aeroplanes come over London, current will not be shut off from the electricity supply mains; in fact, the instructions issued are in the exactly opposite direction. Every effort is to be made to maintain the supply normal and at full pressure, in the event of any of the electricity works or sub-stations being destroyed or partially destroyed.

A little thought will show that the danger of switching off the light would be far greater than that due to bombs dropped from the aircraft. Without even considering the dangers of street traffic in the dark, two classes of building would be affected in such a way as to cause far more casualties than the bomb-throwing. If theatres were suddenly plunged into darkness, the inevitable panic would ensue, for the emergency lighting of theatres is, as a rule, electric as well as the main lighting, although it is supplied by a different company or through a different main belonging to the same company. Hospitals would be in a terrible plight. There should be no panic there, but there would be loss of life in almost every operating theatre. Some of these have separate supply from two companies to provide for emergencies such as engineering breakdowns, but very few London hospitals have their own generating plant or an emergency accumulator reserve.

Some time ago, we believe, an order was issued, at any rate to some of the electricity works in London, to prepare to

reduce their supply pressure by 50 per cent. in the event of certain instructions being received on the approach of hostile aircraft, but this order was very quickly cancelled.

Another interesting phenomenon would occur if the whole of the electric light works were to switch off. Large quantities of steam would have to be immediately blown off into the atmosphere, and the noise would probably startle the inhabitants of the darkened town far more than the explosion of the dropped bombs. Moreover, the rising steam would offer an admirable target for the Zeppelin; a bomb might be dropped on the Bankside electricity works,—and owing to the difficulty in range-finding, St. Paul's, Blackfriars Bridge, and the Central Telephone Exchange would then all be endangered!

Different conditions, of course, arise in the case of small towns, and doubtless the extinction of the lights in Yarmouth and Cromer last week was the correct policy. In such comparatively small places there can be little risk from cutting off the electricity supply if warning is given to the theatres and hospitals—unless, of course, the anti-aircraft searchlights are connected to the public supply mains.

GUARANTEEING WIRING WORK

THE question of giving a better status to the wiring contracting industry through the medium of a guarantee by the Electrical Contractors' Association, so far, of course, as the work of its members is concerned, has been much discussed for several years. A decision has now been come to by the Council of the Association to adopt a scheme of this character. Some details have still to be settled, but at the last Council meeting the following minute was passed:—

The Council shall have power to appoint an independent engineer to inspect any or all installations either during progress or within six months of completion which may be subject to the Association's guarantee, and each member shall grant every facility for such inspection.

In the event of an allegation being made at the instance of one of the members, the Council shall have power to charge the cost of such inspection to the member making the allegation. Work is, however, to be inspected regardless of the fact as to whether or no a complaint has or has not been made.

The Law and Parliamentary Committee of the Association met yesterday to consider the necessary alteration in the Articles of the Association to give effect to the above. The scheme, full details of which will shortly be available, is intended to come into effect on Oct. 1st next.

THE ILFORD CASE

A briefly summarised in our last issue, the Ilford Urban District Council has agreed with the Ilford Gas Co. that the hiring of lamps and motors, the fitting of consumers' premises, and carrying on showrooms is beyond its Parliamentary powers, and also that certain tariffs, giving advantages to persons whose premises are lighted by electricity only, constitute preferential charging, and come within the Long Eaton judgment.

When the matter came before Mr. Justice Sargent on Wednesday last week, however, it was evident that the Gas Company, not content with having gained its main points, viz., a declaration that all the above were illegal, intended to push the advantage so gained to the furthest possible limits. Mr. Martelli, K.C., for the Council, referred to the Company's attitude as an example of "ruthlessness in warfare." In the first place, the Council has some thousands of pounds' worth of motors, arc lamps, and wiring on hire agreements varying from one to five years, and naturally now desires to dispose of them on the best possible terms. A period of twelve months was asked in which to do this, and during this period the Gas Co. was not to be entitled to apply for an injunction. The Gas Co., however, would only agree to three months, and furthermore claimed that under the declaration agreed to by the Council the apparatus in question could not be sold to the present hirers, nor, indeed, at all.

Meanwhile, the Gas Co. has appeared at the annual audit of the Council's accounts, and claims a surcharge of the whole sum expended in hiring and fitting, and there seems no doubt that the Local Government Board auditor will have no alternative but to recommend this surcharge, although, of course, it is within the powers of the Local Government Board to remit it subsequently. Thus, if the Council are advised that under the declaration it cannot sell the apparatus, and the surcharge is duly made, the only course to be followed is for the apparatus to be handed over to the surcharged councillors, who themselves must sell it and set off the amount so received against the surcharge.

Mr. Justice Sargent eventually granted the declaration

agreed between the parties, with liberty to the Gas Co. to apply for an injunction without any restriction as to period. He pointed out, however, that the Council must have a reasonable time within which to dispose of the apparatus in some form, and hinted that he would not grant the Gas Co. an injunction to restrain the Council selling the apparatus should the Gas Co. see fit to apply for one.

The moral to be drawn from the result of this case is that municipal electricity undertakings, desiring to hire out motors, &c., and not having the power to do so, must proceed as many are already doing (see ELECTRICAL ENGINEERING, Jan. 7th, p. 3), and obtain these powers by private Bill. In doing so, it is true, they will in some cases meet opposition from the electrical contractors as well as from the gas companies, but they will certainly have a good case—certainly a better one than when they exceed their powers and have to defend their action in the law courts. As to the tariff question, we have always maintained that it is a mistake to have a number of different tariffs, some of them most complicated. We are convinced that tariffs which are with difficulty understandable by a certain proportion of the consumers—and the reasons for which are understood by hardly any—are a mistake from a purely business point of view, and that as many consumers are lost as gained by them. The rebate to power consumers who have electric lighting, which was condemned in the Long Eaton case, must now be unconditionally abandoned, if indeed it still lingers anywhere, and the only remark to make with regard to this is: Was it ever worth while? The consumer who is already convinced as to the advantages of electric power should, as a rule, need but little convincing as to the advantages of electric lighting; if there are any with such tenacity of opinion that they cannot be convinced by reason, it is unlikely that they will submit to coercion. With the metal filament lamp firmly established as a more economical form of lighting than the gas burner, and with the half-watt lamp making rapid progress, managers of electricity works can afford to give less time and thought to the framing of tariffs asymptotic to the border line which divides preferential charging from allowable tariffs.

SEARCHLIGHTS

AT the meeting of the Illuminating Engineering Society on Jan. 19th, a discussion on searchlights was opened by Mr. P. G. Ledger. The chief essential in a searchlight, he said, was a source of great intrinsic brilliancy and small dimensions. Strictly a "point-source" would be necessary to get an absolutely parallel beam, but in practice there were few instances in which a beam of smaller divergence than 2 to 8 degrees was desirable.

For large searchlights the electric arc was invariably used, and gave an intrinsic brilliancy of about 200,000 c.p. per sq. in. In the modern searchlight the beam was obtained merely by placing the arc at the focus of a parabolic mirror. Dispensing prismatic lenses were often provided in front to spread the beam over a wider angle and enable a considerable area to be inspected at close quarters. In the earlier searchlights inclined carbons were used, and this method was still followed in small projectors. Nowadays the carbons are arranged horizontally, the positive carbon carrying the crater facing the mirror. The negative carbon is made as small as possible so as to obstruct a minimum of light, and various devices are used to increase its conductivity (such as coating the exterior with copper and introducing a copper wire into the carbon).

Mr. Ledger reviewed the historical development of the searchlight, which was first used in the French Navy in 1867, and touched on the work of Fresnel and Mangin. The former replaced the early metal mirrors by silver glass, and Mangin ground the two surfaces of the glass to different curvatures to obtain a nearer approximation to the effect of a parabola. There was, however, now no difficulty in grinding parabolic surfaces of considerable accuracy. A recent improvement had been the introduction of the iris shutter, by which the light could be instantly shut off without interfering with the steadiness of the arc. There were difficulties in rating searchlights in candle-power, as with a concentration beam the light behaved as if coming from a source far behind the mirror at the virtual centre, and with a true parallel beam it was obviously impossible. A 150-ampere projector with a 150-cm. mirror gave a mean horizontal intensity towards the mirror of about 46,000 c.p., and the c.p. of the beam could reach as much as 180,000,000. For the reasons explained, however, it was not usual to specify candle-power. The range of a searchlight was almost

as vague, depending largely on atmospheric conditions; in average circumstances a 150-amp. projector would reveal objects up to 10,000 yards. The range was stated to be proportional to the square root of the diameter of the mirror and the fourth root of the intrinsic brilliancy of the source. It was now necessary, on account of aircraft, to use searchlights at all angles, and even to throw a beam vertically upwards. This introduced some difficulties owing to the danger of particles of hot carbon falling on the mirror. It could be got over by using a lens instead of a mirror or using a further deflecting mirror. It had been suggested to alter the colour of the beam in the red direction of the spectrum to obtain better penetration in fog, but Mr. Ledger was not aware of the extent to which this is done.

Improvements in the manufacture of carbons had been introduced from time to time, but without some radical change in principle it hardly seemed possible to increase very materially the light from an ordinary searchlight except possibly by increasing the brilliancy of the crater.

The steadiness of the arc had been improved by the small diameter of the negative carbon, made possible by the use of a copper core. For a 100-amp. arc the negative would be about 13 millimetres in diameter, and the positive about 27 millimetres, so that the shadow cast by the former—especially with the relatively long arc used in modern searchlights—was inconsiderable. Another device that assisted in steadyng the arc was the use of a horseshoe of soft iron, converted into a magnet by the field of the current flowing through the electrodes to blow the arc downwards. Some of the most important recent improvements had been in the design of remote control apparatus. An officer could now carry out observations through a telescope, so connected with the projector that the latter followed continuously and instantly all the movements of the telescope.

In the discussion, Mr. Justus Eck spoke of an improved design of searchlight recently developed in America. The carbons in this were inclined at a special angle. They were of very small diameter and were continuously rotated, while the points were bathed in methylated spirit vapour. By this means a more concentrated point of illumination of higher specific intensity was obtained, and the crater was concentrated at the end of the carbons. Mr. W. M. Mordey questioned whether a return might not be made to an alternating-current lamp with carbons placed at such an angle to each other that both craters were visible. He believed that in the ordinary lamp the negative carbon screened off some 20 per cent. of the light. With regard to altering the colour of the light, he suggested that this could be done by using chemically impregnated carbons instead of sacrificing some of the existing rays. Mr. Lyon agreed as to the vagueness of candle-power statements and proposed standard conditions of a 10 ft. square screen at 1,000 yards for rating purposes. He referred to portable searchlight plants and an aeroplane outfit supplied by a variable speed dynamo driven by the main engine. Mr. T. Ritchie called upon the society to standardise the ratings of searchlights, and also spoke of the vapour-cooled electrode, which would give an increase in efficiency of 10 to 20 candles per watt and altered the colour of the light in the required direction, giving, in the opinion of the U.S. Naval authorities, greater penetrative power and less glare, so that the observer could be nearer the projector. Mr. F. W. Willcox gave some information as to the use of half-watt lamps in small searchlights, and another speaker said that the French Government used much overrun incandescent lamps in their small searchlights. A report of some American investigations was referred to by Mr. H. Smith; and Mr. Chalmers, speaking of the definition of range, said that it was entirely a question of the size of the object to be picked up. It was of great importance to have as divergent a beam as was consistent with adequate brilliancy, as one was liable with a very narrow beam to miss an object when passed over quickly by a narrow beam. Mrs. Ayrton spoke at some length on the stability of the arc, emphasising the necessity for sufficient voltage of the supply to allow of an adequate series steadyng resistance. There should be something like 50 volts extra to play with. There was a good deal in the handling of the lamps, as well as the correct relation of current voltage, length of arc and size of carbons. Finally, Mr. A. P. Trotter, who was in the chair, made a few remarks, dwelling on the importance of practical details of handling which concerned more than did the theory. What the man who had to use a searchlight had to know was how to strike the arc without jamming the carbons and blowing the fuse; how to lengthen it without putting it out and without making mushrooms, and how to clear them when they did occur; how to fix and change carbons without burning his fingers, and how to work without hurting his eyes. Reference had been made to the C.P. of a searchlight, but he was strongly of the opinion that there was no such thing as the C.P. of a searchlight. He had been hesitating over the use of lumens in photometry, but here he did think that the only way to talk about the practical result of a searchlight was in lumens or flux of light. Mr. Ledger made a few observations in reply.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

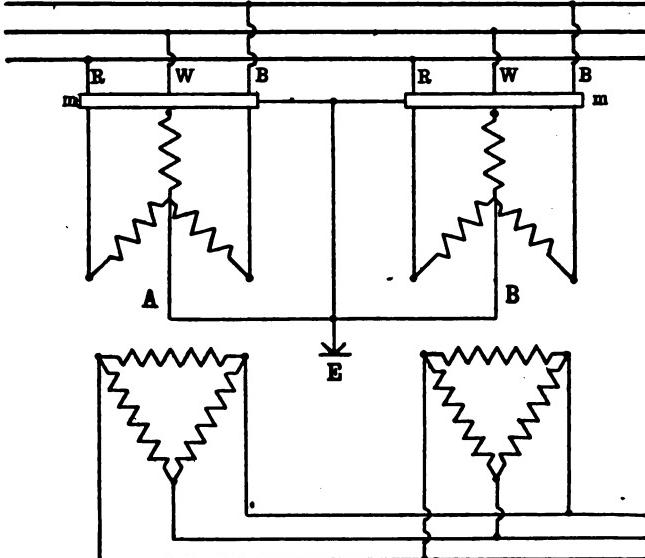
QUESTION No. 1,427.

A shunt-wound commutating pole generator, driven by an induction motor, shirks the load when run in parallel with other identical machines, yet deals satisfactorily with the load when run alone. What is the probable cause of this?—SPARK GAP.

(Answers must be received not later than first post Thursday, Feb. 4th.)

ANSWERS TO No. 1,425.

A number of three-phase, 25-cycle induction motors are connected to three bus-bars supplied from two 200 k.v.a. transformers at 400 volts between phases. Each transformer is provided with a four-wire watt-hour meter, the two potential coils in each case being connected between two of the phase wires,



A.B. TRANSFORMERS. M.M. WATT-HOUR METERS.

and the neutral point of the system, which is earthed. It was desired to check the relative loading of the transformers by simultaneous readings. The only instruments available were two indicating watt-meters, and these were inserted in turn in the phase wires, as shown in the figure. The results obtained were as follows:—

| Trans. former. | Current Coil in Phase. | Potential Coil between Phases. | Watt-meter between Neutral | | Watt-meter Reading. |
|-------------------|------------------------------|--------------------------------------|----------------------------|------------|------------------------|
| | | | Watt-meter Reading. | and Phase. | |
| A | R | R-W | 140 | R | 25 |
| B | R | R-W | 55 | R | 80 |
| A | W | W-R | 180 | W | 80 |
| B | W | W-R | 185 | W | 90 |
| A | B | B-W | 130 | B | 110 |
| B | B | B-W | 200 | B | 85 |

It should be noted that while each pair of readings was taken

simultaneously, the observations of one phase are not comparable with those of another as the load may have altered meanwhile. What is the explanation of the wide variation in the relative values of the simultaneous indications which were obtained?—J. E. F.

The first award (10s.) is given to "OHM," whose reply is given in abbreviated form below:—

It is difficult to imagine what the particular object was of the tests described, for as the three sets of readings were taken at different times, they simply prove that both the load and power factor of each transformer are rapidly changing. Furthermore, in changing the wattmeter from one phase to the other, the potential connections were not made in the proper order. The correct procedure would have been to connect the potential circuit between phases R-W, W-B, and finally B-R, corresponding to the three sets of readings taken on the phases in the order R-W-B. The tests made by connecting the potential circuits between phases and neutral are of value, for assuming that the phases are balanced, the input to each transformer is exactly three times the reading of the wattmeter. It is clear, therefore, that the load on transformer A was very erratic. Presumably the wattmeter reading should be multiplied by a constant to give the true reading in kw., otherwise each transformer is very heavily overloaded. Comparing the readings in the last column of the table, and comparing the three pairs of simultaneous readings, we obtain a comparison between the loads on the two transformers at three distinct periods.

The other readings are of practically no value, although if the two wattmeters had been connected to the same transformer and simultaneous readings of this nature taken, the power factor could have been deduced. Assuming that the phase rotation for the circuit is in the order R-W-B, then the wattmeter with potential coil connected between phases, actually measures $CV \cos(30^\circ + \theta)$ for the current coil in phase R, and $CV \cos(30^\circ - \theta)$ for the other two phases, where C=phase current, V=phase voltage (between phases), θ =phase displacement of current. With the potential connected to the neutral, the wattmeter will in each case measure $CV \cos \theta / \sqrt{3}$.

If J. E. F. wishes to determine accurately the true load conditions of the two transformers it will be necessary for him to connect two single-phase wattmeters to each transformer (in accordance with the well-known two-wattmeter method), and an ammeter in each phase. Simultaneous readings of the ten instruments should then be taken, from which the true kw. load, power factor, and balancing of the phases can be determined for each transformer at the same time, so that a comparison of each of these factors can be made.

The second award is made to J. E. R. R. for the following reply:—

The reason for the varied results obtained is, as suggested in the question, that the power in the line is rapidly varying between the times the several readings were taken. The readings themselves prove this to be the case. The readings in the last column were obtained by a current coil in one phase and a pressure coil between that phase and the neutral point. Now a wattmeter so connected would read, to a high degree of accuracy, one-third of the total power flowing in that circuit,

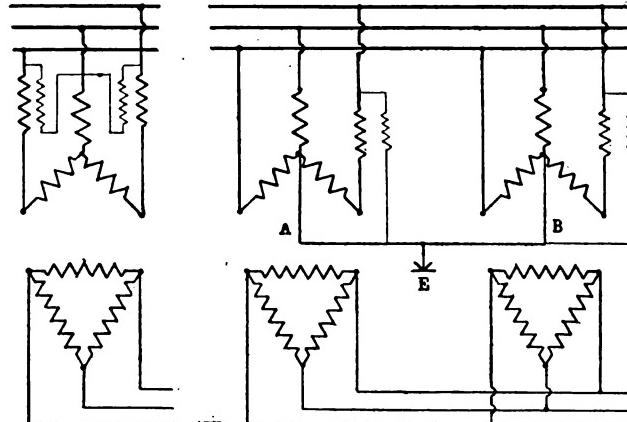


FIG. 1.

providing the phases are balanced. Take the readings for transformer A. There can be no doubt that when the readings 25, 80, and 110 in the end column were obtained, the total power given out by this transformer was 75, 240, and 330 respectively. Similarly for transformer B, when the readings 80, 90, and 85 were taken the power given out was 240, 270, and 255 respectively. So that the power given out by each transformer varies considerably.

The most accurate of all methods of wattmeter connection for measuring the power in a three-phase circuit, balanced or unbalanced, is what is termed the two-wattmeter method, as

shown in Fig. 1. Now according to this method the total power of transformer A should be given by the addition of the readings of line 1, column 4, and line 5, column 4, i.e., 140+130=270, but the closeness of these readings suggest that they are not right. From their ratio we can get the P.F., and for a ratio of $\frac{130}{140} = .928$ the P.F. would be almost unity, which is out of the question for an induction motor load.

Unless special short-circuiting switches are arranged it takes a good deal of time to change the current coil out of one phase into another, even if current transformers are used, and if the load is varying all the time no comparison can be made between one reading and another. The readings given, for this reason, are very unreliable.

Undoubtedly the best method of utilising these two indicating wattmeters to get comparative simultaneous readings of the load of each transformer is to connect them, one in each transformer, as shown in Fig. 2. Each meter will then indicate the power delivered by one phase of the transformer in which it is connected, and therefore one-third of the total power delivered by that transformer to the load. By observing the readings

of these two meters simultaneously over all ranges of load the proper relative loading of each transformer can be accurately obtained.

ANSWER TO CORRESPONDENT

STUART HODGSON.—The address of the secretary of the Institution of Electrical Engineers is Victoria Embankment, London, W.C.

 **BINDING "ELECTRICAL ENGINEERING."** — Vol. X. of "Electrical Engineering" (Jan.—Dec. 1914) closed with our issue of December 31st. Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to THE KILOWATT PUBLISHING Co., Ltd., Temple Chambers, London, E.C., carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad. Binding Cases (including index, but not including binding) 2s. each, or post free 2s. 4d. (Abroad 2s. 6d.) Index alone, 1d. (Post free 2d.).

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 21st, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

29,712/13. **Wireless Telegraphy.** R. C. GALLETTI and GALLETTI'S WIRELESS TELEGRAPH & TELEPHONE CO. A transmitting device capable of dealing with high voltages and currents employing a large resistance and key in shunt with part of a series discharger, and effecting signals by controlling the spark distance of the discharger. (Four figures.)

29,752/13. **Train Control.** B.T.-H. Co. (G.E. Co., U.S.A.). A system of electric train control with regenerative braking in which auxiliary excitation, obtained from a motor-generator on the train, is superimposed on the series field and automatically varied by a regulator of the Tirril or other type, which acts on the field of the auxiliary generator and keeps the value of the regulated current constant. (Two figures.)

5,050/14. **Arc Lamps.** F. W. STURGEON. Arc lamps for searchlights in which, in addition to a refractory fixed stop which prevents the upper carbon descending below a certain point and fixes the position of the arc, there is provided a refractor pivotally mounted abutment, or damper, a little higher, pressed against the carbon by a spring to prevent uneven turning of the carbon and irregular feed. (Three figures.)

10,948/14. **Electric Traction.** C. M. WHITE (M. E. Sturges, New York). A tangential system of traction in which a continuous developed slotted core, with conductors in the slots laid on track, acts as the rotor of an induction motor, and a similar short core on the train carries winding supplied with polyphase current and acts like the stator. By this arrangement the losses are much less than in the reverse arrangement with current supplied to the track and induced in the train winding. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

SUMMARIES OF SOME OF THE MORE IMPORTANT OF THESE PATENTS WILL APPEAR IN OUR NEXT ISSUE.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. (G.E. Co., U.S.A.) [Protective system] 4,133/14.

DYNAMOS, MOTORS, AND TRANSFORMERS: WADE (Mason) [Dynamos] 967/14; RADLEY [Motor control] 1,975/14; JEAL [Regulator for dynamos] 10,505/14.

Heating and Cooking: WILDE [Heating] 15,879/13; PERRY [Baking] 22,359/13.

Ignition: COLE [Sparkling plugs] 27,114/13; ROBERTS [Sparkling plugs] 12,005/14; ROXCE and ROLLS-ROYCE, LTD. [Ignition control] 17,267/14; MASON [Magnetics] 21,966/14.

Instruments and Meters: GRIESBACH and VENNER TIME SWITCHES, LTD. [Prepayment mechanism] 1,363/14.

Switchgear, Fuses, and Fittings: HOPE [Fuses] 22,575/13 and 24,274/13; CHRISTENSEN and WETTERGREEN [Multiple fuse] 518/14; MARKS (Benjamin Electric Mf. Co., U.S.A.) [Switch holders] 2,388/14.

Telephony and Telegraphy: BALSILLIE [Wireless transmitter]

22,537/13; WESTERN ELECTRIC CO. (Woodward for W.E. Co., U.S.A.) [Automatic telephones] 561/14; JEFFERIES [Antennæ] 11,120/14.

Traction: MORRISON [Electromagnetic power transmission for automobiles] 27,617/13; VON KANDO [Trolley-wire supports] 749/14.

Miscellaneous: SHEPARD AND McKECHNIE [Flashlight signalling] 28,834/13; SCOTT [Steering gear] 73/14; WILSON [Enhancing permeability of magnetic material] 194/14; PEMBERTON [Fire alarms] 9,594/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: LA COUR [Converters] 103/15.

INCANDESCENT LAMPS: RAMY, 23,481/14.

TELEGRAPHY: GOLDSCHMIDT [Wireless selector] 14,595/14.

TRACTION: SOC. ANON. DES ETABLISSEMENTS L. BLERIOT [Car lighting] 24,629/14.

MISCELLANEOUS: TSCHUDY [Electro-mechanical thread breakage detector for spinning machines] 24,342/14.

Opposition to Grant of Patents

24,755/13. **Insulators.** F. HANDCOCK. An appeal has been lodged against the Comptroller's decision to allow the grant of a patent on this application, in spite of opposition. The specification describes a tool for boring holes in porcelain insulators during manufacture.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:

2,116/01. **Graphite Manufacture.** O. IMRAY (International Acheson Graphite Co., U.S.A.). A process of manufacturing graphite in which the electric furnace is charged with discrete carbon in the form of lumps embedded in powder along with a carbide forming material. The whole is raised to a temperature sufficient to vapourise the latter material and convert the carbon into graphite.

The following are the more important Patents that have become void through non-payment of renewal fees.

ARC LAMPS: GEB. SIEMENS & CO. [Flame arc carbons] 21,374/09.

DYNAMOS, MOTORS AND TRANSFORMERS: R. BRAUN [Three-phase equaliser system for winding plant] 20,169/05; J. S. PECK [Three-phase load equaliser regulation] 20,895/08; SIEMENS BROS' DYNAMO WORKS, LTD. [Cooling of dynamos] 22,789/09.

IGNITION: F. MÜNZ [Magnets] 22,323/06.

INCANDESCENT LAMPS: WOLFRAM LAMPEN A.G. [Decarbonising metal filaments] 10,891/08.

INSTRUMENTS AND METERS: ABON ELEKTRICITÄTSZÄHLERFABRIK [Meters] 28,271/08.

STORAGE BATTERIES: J. E. O. MÉRAN [Secondary batteries] 21,363/03; E. SOKAL, S. BLOOMFIELD and C. WOLFF [Secondary batteries with forced circulation] 22,000/06.

TELEPHONY AND TELEGRAPHY: G. R. WEBB [Telephones] 22,580/09; A. BURNS [Productions of continuous oscillations] 22,640/09.

TRACTION: H. LEITNER [Brush carrier for train lighting dynamos] 23,042/09; E. WEISSE [Electric vehicles] 23,069/09.

MISCELLANEOUS: H. W. HEADLAND [Fire alarms] 22,617/09.

ELECTRIC TRACTION NOTES

According to the *Electrical World* (New York), the following is the official report issued by the Interborough Rapid Transit Co. of the accident which occurred on Wednesday, Jan. 6th, on the New York Subway, and was reported in ELECTRICAL ENGINEERING, Jan. 14th, p. 17:—"About 8.10 o'clock this morning a short circuit was established on the cables in the man-holes at Fifty-third Street. These man-holes are on either side of the subway, and the cables in them come from the sub-station in Fifty-third Street, east of Eighth Avenue. An examination of two man-holes shows that practically all the cables have been short-circuited and destroyed. These short circuits made a tremendous arc, and created considerable gases and smoke from the burning insulation and the molten metal. The short circuits automatically tripped circuit-breakers in the sub-station, which cut off the power. This automatically took the power away from the third rail and the trains stopped." It appears that the burn-outs occurred in compartments opening into the tunnel, which was filled with smoke, and that this, combined with the panic, was responsible for the injuries to passengers. The account in the *Electrical Railings Journal* states that many of the passengers were rescued through a street man-hole by firemen, but that the latter were not called till one hour and fifteen minutes after the first short circuit occurred. It is further reported that power at reduced voltage was supplied to outlying sections of the line for about half an hour after the first short circuit, and then all power went off. This indicates the gradual progress of the fire in the cable man-holes, the latter communicating with the subway tube by means of steel doors which were insufficient to keep the smoke from the burning insulation out of the subway. The final cutting-off of all power put out the emergency lights that are mounted on the subway walls, although these are supplied from a circuit separate from that supplying propulsion current. All of the cars in the subway are equipped with emergency storage-battery lights, which assisted the egress of passengers.

The Highways Committee of the L.C.C. recommends an expenditure of £6,850 upon the provision of cables in connection with a new arrangement with the London Electric Supply Corporation, by which the latter will give a further

supply of energy to the Council up to 3,500 kw. at £8 per kw. per annum plus 0·4d. per unit. This arrangement is to remain in force for at least six months, but the Council has the option of extending it for a further six months. If after the expiration of the first six months the Council merely requires the supply for stand-by purposes, the charge will be at the rate of £2 per kw. per annum. The cable ducts will be laid by the Company.

The Glasgow Corporation is extending the use of electrically-driven vehicles for departmental purposes. The Cleansing Department has seven, and an additional six are on order.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The large variety of types of private branch exchange boards is apparently to give way gradually to a more uniform system. The *Post Office Electrical Engineers' Journal* describes three standard types of boards which are to be used for future work. Speaking keys, or their equivalent, are now to be universal, and boards serving not more than twenty extensions are to have an audible alarm on the supervisory signals. Cordless boards will be used up to a total of ten lines in all (thus three exchange lines and seven extensions), and in these the extension line signal is controlled by a series relay and acts as a supervisory signal with an audible alarm, which is thus in line with the keys on which the connection is established. Plugging through is to be possible on all boards, and the right connections are provided by special keys, which, when thrown, render the supervisory signals inoperative. The substitution of the relay with a non-inductive winding for the series "eye-ball" signal will provide improved transmission and signalling conditions. A disadvantage of the arrangement of this board is that the extension cannot call in the P.B.X. operator to transfer an incoming call without giving a false supervisory signal at the main exchange, as the clear is simultaneous on both the main and branch exchanges. Larger boards will be double-cord boards arranged so that the extension station controls only the supervisory signal at the P.B.X. and the exchange line is held until the latter clears.

"ELECTRICAL ENGINEERING" TRADE SECTION

CATALOGUES, PAMPHLETS, &c., RECEIVED

CONTINUITY CONDUIT FITTINGS.—A new list from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) describes conduit fittings with the "Demon-grip" device which in its present form obtains the necessary electrical continuity by means of a cheese-headed screw. The relative positions of the screw and tube are such that whilst the thread of the screw is just clear of the tube, the head is forced against the tube when the screw is tightened down, the screw-hole in the lug being specially counter-sunk to allow of this. The sharp bottom edge of the screw head cuts through the enamel and ensures certain continuity even should the enamel not be removed from the end of the tube. In addition the screw acts similarly to a cotter-pin, keying the tube securely into the fitting.

SWITCHGEAR.—An illustrated pamphlet from the British Thomson-Houston Co., Ltd. (Rugby), describes the various forms of switchboard panels for three-phase systems up to 6,600, which they have standardised, including flat back and cellular arrangements of several patterns. A good deal of information is given as to the circumstances in which each pattern has special advantages, and as to the equipment with which it is provided. Another leaflet gives particulars of a magnetic blow-out form of lighting arrester, suitable for continuous-current circuits.

IRONCLAD SERVICE FUSE BOXES.—A new illustrated catalogue of ironclad service fuse boxes is being issued by W. T. Henley's Telegraph Works Co., Ltd. (Blomfield Street, E.C.). A considerable variety of patterns of both open and bridge type fuse boxes are listed, the latter all complying with

the Home Office requirements. A stock of all the patterns listed is kept at the company's various branches. Attention may be drawn to the method of packing employed. The separate boxes are packed in corrugated cardboard cases of a form which can very easily be stacked and given out in perfect condition when required. The types listed are by no means all made by the firm, and new designs are being introduced at a rate which it is impossible for any catalogue to keep pace with.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

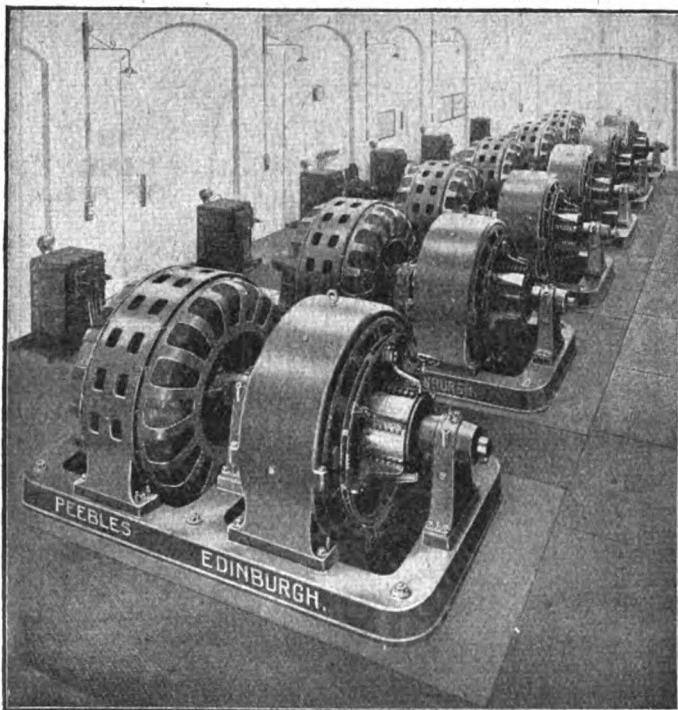
PORTABLE INSTRUMENTS.—A leaflet from Crompton & Co., Ltd. (Chelmsford), describes a portable pattern of continuous-current moving coil instrument made in various ranges up to 600 amperes as an ammeter, and up to 600 volts as a voltmeter. Combined ammeters and voltmeters and multi-range instruments of the same class are also included.

BELLS AND ACCESSORIES.—A list from Julius Sax & Co., Ltd. (24A High Street, New Oxford Street, W.C.), deals very fully with electric bells, buzzers, indicators, pushes, &c., as well as electric light accessories, such as lamp-holders, adaptors, plugs, fuses, ceiling roses, holophane reflectors, and special fittings for this form of glassware.

Ediswan Staff Concert.—A very successful smoking concert was held at their staff café on Friday last by the staff and foremen of the Edison & Swan United Electric Light Co., Ltd. (Ponder's End). Particular mention may be made of the excellent singing of Mr. C. F. Warren and the humorous contributions to the programme by "Little Jack," who is the much worried though exceedingly courteous telephone exchange operator at the works.

PEEBLES MOTOR CONVERTERS

A NEW pamphlet from Bruce Peebles & Co., Ltd. (Edinburgh), gives interesting information as to the Peebles-Les Cour motor-converter, which is now well known and largely in use throughout the world. An effective view of a sub-station of the Calcutta Electric Supply Corporation equipped with these sets is shown below, which reproduces one of the striking series of illustrations in the

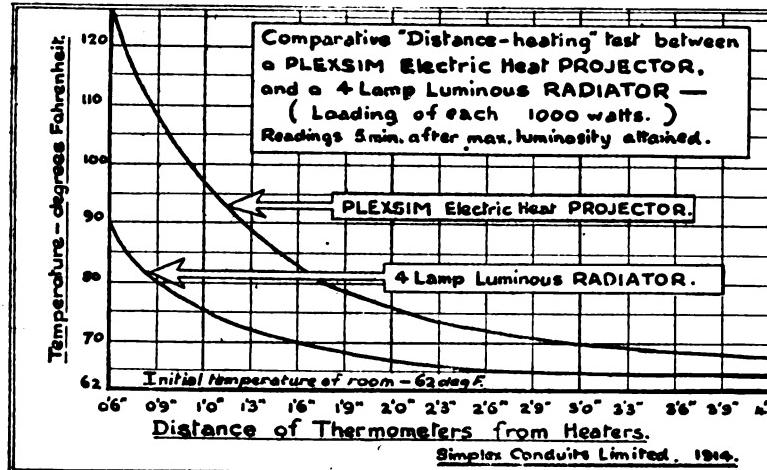


GROUP OF MOTOR-CONVERTERS AT SUBSTATION OF CALCUTTA ELECTRIC SUPPLY CORPORATION.

pamphlet. The principles of the motor-converter are clearly set forth, and the advantages of this class of plant over rotary converters and motor-generators are discussed. It scores particularly in the matter of efficiency and power-factor, and is simpler to handle as regards starting, synchronising, and regulation. Its uses on traction and lighting systems are explained, and its possibilities as a three-wire balancer are pointed out.

ELECTRIC HEATERS

A VERY complete range of electric heaters of numerous different patterns is contained in a new illustrated list just issued by Simplex Conduits, Ltd. (116 Charing Cross



Road, W.C.). The radiators are produced in designs to suit all circumstances, and vary in price from 16s. for a simple single lamp heater to £7 for six-lamp radiators of artistic design. A special feature of these is the arrangement of the wiring, which is carried to screwed terminals in the base, allowing of the radiator being quickly connected up. A large

number of convectors are also listed, and these are all made on the well-known Simplex strip system. The elements employed are very similar in construction to those used in the Company's kettles and other cooking appliances, and consist of non-oxidisable resistance ribbon wound on mica plates, the whole enclosed in a steel frame. A number of these elements are placed in parallel in the heater. Some new designs of the Plexim heat projector (see ELECTRICAL ENGINEERING, Oct. 22nd, 1914, p. 554) are listed, and an interesting curve reproduced here clearly shows its superiority over the ordinary lamp type in the matter of speed of heating up.

A USEFUL ADAPTOR FOR HEATING APPARATUS

IT is often convenient to connect electric kettles, irons, or other pieces of domestic heating apparatus to an ordinary lamp-socket without interfering with the use of the lamp, so that the heater and lamp can be put on and off independently or used at the same time. The adaptor illustrated here, which is made under Patent No. 27,503/12, has been put on the market by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), to meet these conditions. As will be seen, it fits in an ordinary lamp-holder, and provides for a lamp in a line with its original position, while the holder into which the adaptor plug connected to the heating circuit is at the side at such an angle as not to interfere with a shade being used on the lamp with the ordinary shade ring as shown. A simple and well-made switch in the body of the adaptor turns the light on and off, and the heater is controlled by inserting and withdrawing its plug. The construction of the apparatus is very ingenious. The body is split in a vertical plane, and these two halves, made of insulating material, form at the same time the lamp-holder insulator and completely enclose all live parts except the top adaptor contacts and the lamp-holder plungers. The device should have a considerable field of usefulness.



SWITCH ADAPTOR FOR LAMP AND HEATER.

WE illustrate here a pattern of fitting for half-watt lamps made at the Ponders End works of the Edison



CAST-IRON FITTING FOR HALF-WATT LAMPS.

& Swan United Electric Light Co., Ltd., and put on the market at a very moderate figure. The fitting is made of

COMPETITIVE PRICES.
QUICK DELIVERY.

ELECTRIC BELLS
Indicators, etc., and
ELECTRIC LIGHTING ACCESSORIES
of all kinds.
Send for
Lists from
C. M. SIMPSON,
4, St. Augustine's Place,
TRAMWAY CENTRE,
BRISTOL
'Phone 1083.

BASTIAN METERS

from 10/6 each.

Made in ENGLAND with
BRITISH CAPITAL and
BRITISH LABOUR
THE BASTIAN METER CO., Ltd., Bartholomew Works, Kentish Town, N.W.

BLAKE & INSULATING STAPLES

Write for Samples and Prices.

MOSSES & MITCHELL,

Chiswell Works, 122-124, GOLDEN LANE, E.C.

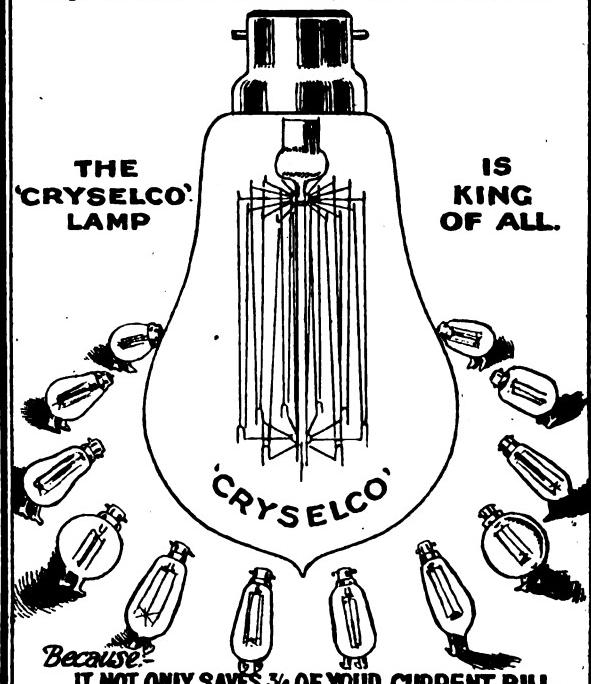


"RADIOLAC"

CHAS. H. BLUME,
Insulating Varnish Dept., The White Building, SHEFFIELD.

ALL OTHERS BOW BEFORE

The CRYSELCO
METAL FILAMENT LAMP.



SUN FITTINGS FOR HALF - WATT LAMPS

**BRITISH MADE
THROUGHOUT**

Designed to give the most efficient distribution of light.
Ample ventilation is provided. Both outside (weather-proof)
and inside types are ready in a variety of patterns.

Full particulars in List 263. Free on request.

We hold large stocks, and can give immediate delivery of all the well-known Half-Watt and Tungsten Lamps, also Carbons and other Types.



L 1740.

For Half-Watt Lamps up to
3,000 c.p. Finish : Vitreous Black
wired White Enamel. Opalescent
Globe.

33/- each (sub.)

The **Sun** ELECTRICAL COMPANY
118-120 Charing Cross Road, London, W.C.

When corresponding with Advertisers, please mention "Electrical Engineering."

high grade cast-iron finished in brilliant black enamel, and is suitable for interior or exterior use. Two sizes are made, one for 100-watt to 300-watt lamps, and the other for lamps up to 1,000 watts. A simple form of adjustment of the lamp position is provided, and a special English opalescent globe is employed. A similar fitting is also made which is surrounded by an 18-inch reflector.

THE B.E.A.M.A. JOURNAL

THE British Electrical and Allied Manufacturers' Association has issued the first number of a finely-printed quarterly journal. We understand that its main object is to introduce the Association and its members—or, at any rate, the firms who have advertised in it—in the Colonies and abroad, and that a few thousand copies have been sent out to a carefully-compiled list of recipients. It is not intended that the journal shall be a burden on the Association, but it is to be self-supporting by means of the revenue derived from the advertisements it contains. A feature is a classified list of manufacturers in four languages, English, French, Spanish, and Russian, of the names of those firms who have contributed to the support of the publication. A full list of the firms belonging to the Association is not included. Useful international tables of weights, measures, and money are included, and introductory notices, not only in the four languages mentioned, but also in Italian, Japanese, and Chinese. The journal contains some excellent articles, a few of a technical character, and several pages of trade announcements of an advertising nature.

CORRESPONDENCE

REDUCED STREET LIGHTING.

To the Editor of "ELECTRICAL ENGINEERING."

SIR.—I have read with interest the remarks regarding the Wardle Engineering Co.'s lantern in your current issue, in which reference is made to my design of reflector, which you kindly described in your issue of the 1st inst. The Wardle Engineering Co., and possibly others of your readers, seem to have misunderstood the object of this reflector. It has not been introduced as an example of the best type of fitting it is possible to employ for street lighting purposes, but merely as an expediency to meet the present circumstances, and, as pointed out in your article, is intended to be adapted at a cost of a few shillings to any existing lamp, either gas or electric, in preference to the present inefficient method of painting the globes. The point raised by your correspondents that to obtain an even illumination it is very important to get the maximum candle power very near to the horizontal is quite true, but it should be borne in mind that as the angle of maximum intensity is raised the value of the candle power must be increased enormously if any illumination is to be obtained at that angle worth having. For example, whilst the lantern described by the Wardle Engineering Co. gives its maximum candle power at 17° below the horizontal, the horizontal illumination given by this ray is only 5 per cent. of the maximum illumination occurring beneath the lamp, or, in other words, in order for this lantern to give a uniform illumination over the 80-ft. radius referred to, its maximum candle power would have to be twenty times that shown by the polar curve. In the "Beuttell" reflector the corresponding ratio of the illumination given by the maximum ray to that beneath the lamp is 50 per cent., the resulting illumination given by two such reflectors being therefore approximately uniform with the illumination below the lamp.

109 Victoria Street, S.W. Yours faithfully,
Jan. 23rd, 1915. ALFRED W. BEUTTELL.

[It may be suggested that the principal requirement is really that there should be no possibility of reflection from the white surfaces of buildings, &c., and that therefore the maximum degree allowed should simply depend on the width of the street. The ideal would appear to be an adjustable reflector.—*Ed.*, E.E.]

Fire Extinguishers.—The Pyrene Co., Ltd. (19/21 Great Queen Street, W.C.) have made some improvements in their well-known fire extinguisher (see ELECTRICAL ENGINEERING, May 21st, 1914, p. 287, which is now made with a hexagon head that can be tightened with an ordinary spanner. In speaking of its special applicability to electrical purposes they point out that the liquid employed has extinguished 220 volt, 2,000 ampere arcs, and that a jet has been played on 110,000 volt transmission lines without any effect on the operator holding the apparatus.

Ball Bearings.—The Engineering Standards Committee has issued an Interim Report on British Standard Sizes of single row ball journal bearings for automobiles. A complete report giving tolerances, &c., will be issued later, but at the request of the Society of Motor Manufacturers and Traders the sizes settled are published now.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—Twenty-two miles of paper-insulated lead-covered cable. Deputy Postmaster-General, Melbourne. Further particulars at 72 Victoria Street, S.W. Feb. 9th. This information is only of use to firms who can instruct agents by cable.

Barnet.—The Guardians have rejected an offer by the North Metropolitan Electric Power Supply Co., in favour of installing their own generating plant.

Barnsley.—A loan of £4,800 is to be taken up for electrical extensions.

Bristol.—Twelve months' supply of carbons, meters, arc lamp globes, joint junction and fuse boxes, &c. City Electrical Engineer. Feb. 11th. (See advertisement on another page.)

Cleethorpes.—Loans for the following are to be applied for:—Mains, £7,870; services, £965; cut-outs, £148; switchboard, £198; and meters, £819.

Grimsby.—A new battery is to be installed at an estimated cost of £5,000.

London: Islington.—An expenditure of £55,393 has been sanctioned upon electrical extensions. These include four water-tube boilers and H.T. trunk mains.

St. Pancras.—Arc lamp carbons. Borough Electrical Engineer. Feb. 15th. (See advertisement on another page.)

Rochdale.—Sub-station switchboard. Borough Electrical Engineer.

South Africa.—The Durban Corporation proposes to expend £350,000 upon developing the electric lighting, tramway, and telephone systems.

Southend.—Loans of £30,184 for sub-stations at Leigh and Thorpe Bay and £18,000 for cables have been sanctioned.

Wiring

Ayr.—Additions to existing hospital and construction of new one. Borough Surveyor, Town Hall.

Cardiff.—New technical institute, 750 points. City Electrical Engineer.

Manchester.—Home for girls. Electric lighting and bells. Education Offices.

Tyldesley.—Co-operative Society's premises.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdare.—Cinematograph theatre, Market Street. T. W. Griffiths, Victoria Square.

Bury.—Home for girls. Architect, A. Hopkinson.

Chapel-en-le-Frith.—The Board of Guardians contemplates an electric lighting installation.

Hull.—New hospital for Guardians. Clerk, Harley Street.

Sheffield.—Extensions to Lodge Moor Hospital.

Sunderland.—School, Barnes Estate (£40,000).

Tottenham.—School, Philip Lane. Clerk, Education Offices.

Miscellaneous

Beckenham.—Meters, service-boxes, &c. Borough Electrical Engineer.

Birmingham.—Twelve months' supply of electrical stores for the Birmingham, Tame, and Rca Drainage Board. Engineer, Tyburn Street.

Colchester.—Twelve months' supply of lighting fittings for cars, and overhead equipment. Tramway Manager. Feb. 6th.

Leicester.—The Lighting Sub-Committee has unanimously recommended the adoption of electric lighting for the tramway routes, after having carried out experiments with both gas and electricity.

Marylebone Special Constables.—As we have previously announced, the whole of the electricity works staff at Marylebone have been enrolled as special constables, their primary duties being the guarding of the electricity works, although, of course, they are called upon for other duties when required. Last week the whole of the staff were inspected by Col. Reay, the Inspector-General of the Special Constabulary. Mr. A. H. Seabrook, the Borough Electrical Engineer, is a Divisional Superintendent, and the Sub-Inspectors include Mr. H. H. Holmes, the Sales Manager, and Mr. C. H. Smyth, Mains Engineer.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Coventry.—An order has been placed with Messrs. E. Bennis & Co. for a complete coal and ash handling plant.

London: Hackney.—The existing contract with the British Insulated & Helsby Cables, Ltd., for cables and cable-boxes has been extended for three years, with a sliding scale covering market fluctuations in the cost of copper and lead.

L.C.C.—The Stores Committee recommends the acceptance of the Easton Lift Co.'s tender at £445 for an electric lift for the stores premises in Clerkenwell.

APPOINTMENTS AND PERSONAL NOTES

The following changes in the staffs of the Metropolitan District Rly. Co., the London Electric Rly. Co., the City & South London Rly. Co., and the Central London Rly. Co. are announced:—Mr. W. E. Mandelick, in addition to his office as Secretary, is appointed Business Manager; Mr. Z. E. Knapp is appointed Manager for Maintenance and Construction; and Mr. H. E. Blain, late General Manager West Ham Corporation Tramways, is appointed Operating Manager to the above Companies. Mr. W. E. Blake, in addition to his position as Superintendent of the Line to the District Railway, is appointed Superintendent of the Line to the London Electric, City & South London, and Central London Railways, in place of Mr. J. P. Thomas, who has resigned his position with these Companies to become General Superintendent of the London General Omnibus Co., Ltd.

A recommendation by the Brighton Tramways Committee that Mr. W. Marsh, the Tramways Manager, should be granted an honorarium of 50 guineas in recognition of his services in connection with trolley omnibus experiments, has been rejected by the Council, as was also a subsequent recommendation that the honorarium should be paid at the close of the war.

Mr. C. C. Atchison, Borough Electrical Engineer, Rochdale, has been granted leave of absence owing to ill-health.

Mr. Harold Gray, Borough Electrical Engineer, Accrington, has been granted a commission in the Royal Artillery.

Mr. W. J. Leeming, Chief Electrical Engineer to the Buxton U.D.C., has resigned in order to join the Royal Engineers.

Mr. A. Brown, Chief Assistant Electrical Engineer at King's Lynn, has resigned.

Mr. E. S. Carling, late representative of the Electrical Co., Ltd., for the South of England, has joined the Royal Engineers.

An assistant is required in the Meter Department at the Dewar Place Electricity Works, Edinburgh. City Electrical Engineer.

A switchboard attendant is required in the Salford Electricity Department. Borough Electrical Engineer.

A switchboard attendant is required at Kendal. Borough Electrical Engineer.

Switchboard attendants are required by the L.C.C. (See advertisement on another page.)

A car-shed fitter is required in the Swindon Tramways Department. (See an advertisement on another page.)

Improvers are required at the Bedford electricity works. (See advertisement on another page.)

A consulting engineer has been advertised for by the Islington Guardians on the basis of 5 per cent. commission. Clerk, St. John's Road, Upper Holloway.

LOCAL NOTES

Carlisle: *Electricity Charges.*—A recommendation by the Electricity Committee that the kw. charge for current taken during restricted hours should be comparably reduced was the subject of considerable discussion at the last meeting of the Council, especially on the part of the members of the Gas Committee. There is considerable hostility between the Gas and Electricity Committees, and eventually the recommendation was referred back by 18 votes to 15.

Edinburgh: *Municipal Wiring Abandoned.*—The Council has, after all, decided not to proceed with the proposed powers for electric wiring work, &c. This decision was come to by a vote in the Council sitting in Committee, the figures being 20 against and 13 for the clauses.

Gillingham: *Lamps on Hire.*—Owing to the fact that shopkeepers are not allowed to use their outside lamps at present, the Council has decided to reduce the charge for the hire of such lamps to 1s. per quarter, and not to charge meter rents during the period of the war.

London: *Hampstead: Shortage of Coal.*—The Council's coal contractors having notified that they are unable to give any further deliveries owing to the collieries being closed, the Chief Electrical Engineer has been compelled to accept tenders for supplies in lots from 100 to 500 tons from other sources. At one time the stock of coal in hand had diminished to only three days' supply.

Southampton: *Domestic Supply Tariff.*—Last year, as reported in these notes, there was considerable controversy between Mr. H. F. Street, the Borough Electrical Engineer, and the Chairman of the Electricity Committee, as to the commercial soundness of the 0·5d. charge for energy used for domestic purposes other than lighting. Sir John Snell, who was subsequently called in, recommended that it would be better to make the charge on the kw. basis plus a small charge for energy used; but the Electricity Committee, having considered this matter, have now recommended that no alteration be made in the present basis of charging.

Southport: *A Central Stores.*—The Electricity Committee has suggested the formation of a central stores which shall deal with the requirements of all the Corporation Departments. It is suggested that by adopting this plan considerable savings can be effected.

Stafford: *Electricity and Gas Management.*—A suggestion has been made to the Council that the management of the electricity and gas undertakings should be in the hands of separate committees. Information is to be obtained from other towns before coming to a final decision.

Sydney: *Preference to British Goods.*—The Sydney Corporation has adopted a recommendation by the Electric Light Committee, giving a preference of 10s. per cent. to British-made goods and 5s. per cent. to the manufactures of Allies, as against neutrals. The test of whether a company is British is to be that the share register must show that the majority of shareholders are resident in Great Britain or Colonies.

The Electric Vehicle Committee.—At the last meeting it was decided to circularise undertakings with a view to the adoption of the standard charging station sign. The standardisation of lamps for electric vehicles was reported to have been referred to a sub-committee of the Tungsten Lamp Association. The committee recommend the adoption of the sizes of wheel rims for solid tyres standardised by the Engineering Standards Committee at the instance of the Society of Motor Manufacturers and Traders.

The Queen's Engineering Works Magazine.—The January issue of the magazine of the works of W. H. Allen, Son & Co., Bedford, contains a list of 300 men of the office staff and works now serving with the colours. A number of interesting letters from men at the front appear, and there is an obituary notice of Capt. J. Francis Allen, who died of his wounds at Ypres in November last. An illustrated article describes the training of the Bedfordshire Yeomanry, and among the subjects of technical contributions are centrifugal pumps, steam turbines, and the new Hull Docks.

Railways and the War.—We have received a copy of an interesting book, partly consisting of matter reprinted from the *Railway News*, entitled "Records of Railway Interests in the War, Part I., British, August to December, 1914." Illustrated articles give some particulars of the ways in which the railways served their country in arranging for and carrying out transport of troops and in other ways, and statistics of the many railway men now serving with the colours, and detailed descriptions of the splendidly equipped ambulance trains and other special rolling stock, prepared by the various railway companies. The price of this publication is 1s.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, FEBRUARY 4, 1915.

[PRICE ONE PENNY.
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The Engineering Journal of the Electrical Industry

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Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

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SUMMARY

THE greater part of the extension of the "Bakerloo" Railway to Queen's Park, where it will link up with the L. & N.W. Railway, was opened last Sunday. We give some details of the sub-station, escalators, and other equipment (p. 44).

STATISTICS as to the increase in the use of electric power in mines, electrical accidents, &c., are contained in a Home Office report (p. 45).

AN interesting paper contributed to the South Wales Institute of Engineers by Mr. T. G. Watts describes experiments leading to the evolution of a safe system of running bell signalling without risk of ignition of inflammable gas (p. 45).

A PAPER by Mr. T. D. Robertson, read at the Manchester Section of the Institution of Electrical Engineers, described the principal types of electric furnace used for steel making, and, in particular, the "Electrometals" furnace (p. 46).

THREE patterns of electric miners' lamps have been approved by the American Bureau of Mines (p. 46).

A PAPER by Mr. Ll. Foster, before the Association of Mining Electrical Engineers, reviews some of the principal matters that require attention to prevent breakdowns of colliery electrical plant (p. 47).

ILLUSTRATED articles describe electrical rolling mill and ventilation equipments (pp. 47 and 48).

A REPORT has been published by the Research Committee of the Institution, on the properties and testing of transformer and switch oils (p. 48).

THE I.C.C. electric power scheme was defeated in

the Council on Tuesday, and the Bill cannot now be proceeded with this session (p. 49).

THE specifications published at the Patent Office last Thursday include a very simple form of electric steering gear control. Others relate to the "Fluvent" fuse and a method of improving the permeability of iron to small magnetising forces. One of the original Edison battery patents, a Berry transformer patent, and one relating to the Creed system of high-speed telegraphy expire this week after fourteen years' life (p. 50).

THE critical speeds of turbo-generators and the trueing up of commutators are dealt with in our "Questions and Answers" columns (p. 50).

DIRECT telephone communication has been established between New York and San Francisco (p. 51).

A NEW line of D.C. motors, an interlocking switch plug, and some electric cooking appliances are described in our Trade Section (p. 52).

EXTENSIONS are contemplated at Luton (£27,000); Blackpool (£24,500); Walthamstow (£14,590); mains, switchgear, &c., are required at Haslingden (£12,000); motors, &c., at Blackburn; and feeders and distributors at Newcastle-under-Lyme; electric lighting schemes are to be put in hand at Blackrock and Caerphilly, two water-tube boilers are required at Rotherham, and two rotaries at Stockton (p. 53).

IT was almost necessary to discontinue supply at Wimbledon on Tuesday, owing to shortage of coal.—The possibility of a bulk supply from Woolwich to Erith has again been raised (p. 54).

Arrangements for the Week.—(To-day) Thursday, Feb. 4th.—Greenock Electrical Society, 21 West Stuart Street. "Illumination," by F. B. Humphriss, 7.30 p.m.

Friday, Feb. 5th.—Royal Institution. "Science and Industrial Problems," by Prof. A. W. Crossley. 9 p.m.

Monday, Feb. 8th.—Electro-Harmonic Society. Concert (Ladies' Night), Holborn Restaurant. 8 p.m.

Institution of Mechanical Engineers. Graduates' Section. "History of the Metallurgy of Iron and Steel," by Sir Robert Hadfield, F.R.S. 8 p.m.

Tuesday, Feb. 9th.—Institution of Electrical Engineers, Manchester Section, Liverpool University. "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant. 7.30 p.m.

Institution of Electrical Engineers. Scottish Section, 207 Bath Street, Glasgow. "Distribution and Rise of Temperature in Field Coils," by Prof. Magnus Maclean, D. J. M'Kellar, and R. S. Begg. 8 p.m.

Rugby Engineering Society. "Modern Surface Condensing Plants," by T. R. Houston. 8 p.m.

Wednesday, Feb. 10th.—Institution of Electrical Engineers. Yorkshire Section, Technical College, Bradford. "Wireless Telegraphy," by Prof. E. W. Marchant. 7 p.m.

Institution of Electrical Engineers. Birmingham Section, University. "Polyphase Commutator Machines," by W. Shuttleworth. 7.30 p.m.

Institution of Automobile Engineers, at Storey's Gate, S.W. "Magneto-Ignition," by J. F. Henderson. 8 p.m.

Association of Engineers-in-Charge. St. Bride Institute, Fleet Street, E.C. "Boilers and Boiler Mountings," by Vernon Smith. 8 p.m.

THE QUEEN'S PARK EXTENSION OF THE "BAKERLOO" RAILWAY

THE latest extension of the Baker Street & Waterloo line of the London Electric Railway Co., from Paddington to Queen's Park, is important as being a step towards through running between this tube line and the London & North Western Railway, for it is ultimately intended to run through trains between the Elephant and Castle and Watford. The line was opened to traffic as far as Kilburn Park (Cambridge Avenue) on Sunday, and the intermediate station at Warwick Avenue, is also in use. The station between these two at Maida Vale (Elgin Avenue) is not quite complete, nor is the junction with the L. & N.W. Rly. at Queen's Park. The trains, however, are all run on to Queen's Park empty, as there is no cross-over at Kilburn Park. With the exception of a short length of surface line leading into Queen's Park, approached by an inclined cutting, the whole line is the standard 11 ft. 8½ in. twin tubes, enlarged to 21 ft. 2½ in. at stations, and 12 ft. on curves. There are some considerable gradients and curves on the line. A large amount of the detail work follows the standard practice of the London tube railways. The principal point of novelty is the total absence of lifts at all the new stations, which are provided with escalators, and this entails a slight difference in their general lay-out. Broadly speaking, they are of the island platform type, as the tubes are at a greater distance apart than usual, and a spacious lower hall communicating with the platforms and the bottom of the inclined escalator shaft lies between them without any long exit passages. There are also some differences in the sub-station and signalling equipment, described in more detail below.

One new sub-station, adjoining the Kilburn Park Station, has been established in connection with the extension, equipped with plant manufactured almost entirely by the British Thomson-Houston Co., Ltd. (Rugby). This installation is normally fed by one new 11,000-volt three-phase feeder cable direct from the Lots Road power house (see ELECTRICAL ENGINEERING, June 12th, 1913, p. 341), and there is also an emergency E.H.T. feeder, which is looped in at Baker Street. These incoming feeders are protected at the sub-station by multi-gap surge arresters with carbon resistances. The main converting plant consists of three 1,200-kw. B.T.-H. rotary converters permanently connected up to their transformers. They are provided with induction motors for starting up, and are wound for six-phase 25 cycles, running at 400 r.p.m. and delivering 600 volts D.C. The rotaries are provided with an automatic rocking-end play device, which, together with the lubricating qualities of the special brand of Morganite brushes used, keeps the slip-rings and commutators in excellent condition. The switches for the starting motors are alongside the machines at the operating handles for the 11,000-volt switches belonging to the primaries of each group of transformers are also on pillars by the machines. The switches themselves are in cells behind the L.T. switchboard, worked by rodding and provided with the usual automatic trips and synchronising arrangements. The E.H.T. bus-bars are in cells on a gallery above, where sectionalizing switches are provided to cut out any portion in case of emergency. The low-tension board on the floor level is of handsome grey marble on a pipework frame, and is very straightforward in its arrangement. Like all the switchgear, it was supplied by the B.T.-H. Co., but for the sake of uniformity with the other sub-stations it is equipped with Westinghouse circuit-breakers. The indicating instruments are by Everett, Edgcumbe & Co., and the meters by Chamberlain & Hookham, Ltd. Four traction feeders and one escalator circuit feeder are connected up, and two spare feeder panels are provided.

Two transformers of the Berry air-cooled type (supplied by the British Electric Transformer Co.), "Scott" connected across the three-phase supply, give a two-phase 220-volt supply for station and tunnel lighting, but a certain number of lights in each station are supplied from the local supply mains, to remain alight in case of the supply from Lots Road failing altogether. It is also the practice on the whole tube system to arrange the lights so that they can be supplied from a neighbouring sub-station in the event of the nearest sub-station having to shut down. There is also a special 50-kw. transformer to supply the signalling circuit at 400 volts A.C. This is not connected to the 11,000-volt supply mains, but to the 375-volt side of the transformers for the rotaries.

The track is of the same type as already familiar with the older portions of the London Electric Rly. Co.'s tubes, with a substantial felt packing piece under every chair to

deaden noise, and with the sleepers supported rigidly by concrete in the centre, but with only a loose packing at the ends to give a certain degree of spring to the track. The principal difference is in the use of slag wool for the packing under the ends of the sleepers, and Stuart's patent metal rail keys instead of wood. The surface portion is similar, but with the sleepers laid in ballast in the ordinary way. The conductor rails and insulators are similar to those used throughout the system. (A section of this form of track was given in ELECTRICAL ENGINEERING, Jan. 3rd, 1907, p. 38, in connection with another tube line.) Automatic signalling is used up to Queen's Park, where there is a semi-automatic frame with the usual illuminated diagram. The signal gear was supplied by the McKenzie Holland and Westinghouse Co., and is on the alternating-current all-electric system instead of the electro-pneumatic system, with continuous-current track circuits used on the original tubes. Bare telephone wires are stretched along the tunnels so that the driver of any train can communicate by his portable set in case of emergency, and these are connected up direct with the nearest sub-station. In the older parts of the line they were connected to the station platforms. Another novelty is the use of illuminated indicators on each section, which show the word "Stop" if the current goes off the section ahead.

The escalators or moving stairways were supplied by the Otis Elevator Co., and, running at 90 ft. per minute, can deal with 12,000 passengers per hour. At each station there is one ascending and one descending escalator, with a fixed emergency stairway between. The descending escalator is made reversible for use either when the other is disabled or to augment its capacity in special circumstances. Each is driven by a pair of 30-h.p. 600-volt motors running at 650 r.p.m. through a double worm-gear, similar to that used on the lifts, and spur-gearing and large sprocket-wheels engaging the chain by which the little trucks carrying the steps are propelled. The moving hand-rail is driven by chain-gearing. A solenoid starter giving automatic acceleration controls the motors, and clutches are provided so that either motor can be put out of action if necessary.

Ventilating plant is installed at Warwick Avenue and Elgin Avenue. In each case a 40-in. Sirocco fan driven by an 8.B.H.P. continuous-current motor draws in air, and passes it into ducts leading to the tunnel through a spray purifier, in which water is circulated by a small motor-driven centrifugal pump.

The station platform lighting is by 100-c.p. metal filament lamps in translucent glass bowls about 10 yards apart, and forms a fine example of the beauty and evenness of semi-indirect lighting. The escalators are lighted by 35-watt lamps placed in recesses in the ceiling in such a way as to shield them from the eyes of descending passengers. The appearance as well as the arrangement of the stations is a great improvement on some of the older tube stations that we have been accustomed to, and the ample but restful lighting increases one's power of appreciation of these good points. In conclusion, we wish to express our thanks to Mr. Z. E. Knapp, Construction Manager to the London Electric Railway Co., for permission to make a personal inspection of the sub-station and stations, and to those of the Company's staff who received our representative.

Annual Inspection of Commercial Motor Vehicles.—Although the usual Whit-Monday parade of commercial motor vehicles will not be held by the Commercial Motor Vehicle Users' Association, arrangements are being made for an inspection of the competing vehicles to be made, and a series of prizes to be given to drivers on the result of this inspection, combined with written and oral examinations, in connection with which a scheme of correspondence instruction is being prepared. There is a special section for drivers of electric vehicles. Particulars can be obtained from Mr. F. G. Bristow, Sec. Commercial Users' Association, 83 Pall Mall, S.W. In the electrical section, a first prize of £5, a second prize of £3, and a third prize of £2 are being provided by the Electrical Vehicle Committee of the Incorporated Municipal Electrical Association.

British Goods for the French Government.—The Board of Trade has issued a notice giving regulations for the export of articles for the use of the French Government. Application for permission to export prohibited articles must be made to the Commission Internationale de Ravitaillement, India House, Kingsway, W.C. and all documentary evidence of the destination of the goods must be approved by the correct department of the French Government. Application for permission to export goods to France for purely industrial purposes will continue to be made to the Commissioners of Customs and Excise, Custom House, E.C.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

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ELECTRICITY IN MINES IN 1913

PART II. of the general report of the Chief Inspector of Mines for 1913 has recently been issued, and contains the report of Mr. R. Nelson, Electrical Inspector of Mines, dealing with the continued increase in the use of electricity in collieries, and the lessons to be learnt from the accidents which occurred during that year in connection with electrical working. He states that the total h.p. of colliery electric motors is 628,098 (of which 256,676 are on the surface and 371,422 underground), which is an increase of 22·97 per cent. over the figure for the previous year. The coal-cutting machines in use at the end of the year were 1,307 in number, an increase of 173 over the total for 1912.

Accidents.—The fatal accidents due to electrical causes were 15 in number, causing 18 deaths, in addition to a fire at Blaenavon resulting in the loss of 3 lives, which was held by some to have been due to failure of an electric cable, and the Senghenydd disaster, due "possibly but not certainly" to sparks from electric signalling apparatus. All the 15 fatal accidents referred to were due to shock, and 12 of them took place below ground. The total number in 1913 was 13, but in general during the last few years the number of fatalities relatively to the total electric power used in mines shows a decrease, in spite of fluctuations from year to year. Mr. Nelson is of opinion that 9 of the 12 fatal underground accidents might have been avoided by greater care in the maintenance of apparatus and stricter regard to the regulations.

The surface accidents include one due to accidental contact with an imperfectly insulated part of the winding of a 3,000-volt motor. Another was caused by a derrick pole guy-rope becoming live by contact with an unprotected 400-volt three-phase motor fuse, and the third was due to ignorance of a boy who climbed a railing and touched a wire purposely out of bravado.

Of the underground fatalities, 7 were due to contact with outer coverings of apparatus live through the absence of, or an inefficient, earth connection, 4 to defective insulation, and 2 to contact with uninsulated live parts.

Summarising the records of such accidents since 1905, Mr. Nelson finds that defective earthing has been responsible for very closely 50 per cent. of the deaths due to electric shock below ground, and imperfect insulation of cables has been responsible for 37 per cent. of the underground fatal shock accidents; one was on a low-pressure three-phase system, two on medium-pressure continuous-current systems, and the remainder on medium-pressure three-phase systems. Of all the three-phase accidents, including the surface as well as underground, ten were on completely insulated systems, and three on systems with the neutral earthed.

The non-fatal electrical accidents or dangerous occurrences are reported as 53, including 3 underground fires and 50 shock accidents, 30 below ground and 20 on the surface—in all, 51 persons were injured. In three of these cases the victim was unconscious, but was revived by artificial respiration. In four other cases serious injury by burns was caused. One was due to a spanner being dropped across live parts on a switchboard, one to accidental contact to live parts with a pair of pliers, one to failure of a trailing cable, and the other to examination of a switch known to be live. Another peculiar accident was the blowing-out of the glass in the peephole of a coal-cutter motor by explosion of volatilised insulating varnish due to a short circuit.

Prosecutions.—During the year 56 cases of prosecution of mine officials for contravention of the electricity regulations were heard and 24 convictions obtained, resulting in fines and costs aggregating £141 11s. There were 12 other cases in which charges in connection with electricity were taken together with other charges. In 12 cases workmen were charged with similar offences; all were convicted, and fines and costs amounting to £9 15s. were imposed.

Coal-cutting Machines.—Of the total of 2,897 coal-cutting machines in use at the end of 1913, 1,307 were electrically-worked, and of these 700 were in Scotland, 184 in the Northern district, 331 in the Yorkshire district, 18 in the

Manchester and Ireland district, 23 in the Liverpool and North Wales district, 36 in South Wales, and 70 in the Midland and Southern district; 725 were of the disc type, 377 of the bar type, 193 of the chain type, 5 of the percussion type, and 7 were rotary heading machines. The total number of electrical coal-cutters for the previous year was 1,134.

Electric Safety Lamps.—Another subject to which attention is given is the increasing use of electric safety lamps, in use since the facts brought out in the Whitehaven and Hulton colliery inquiries. In 1911, 4,298 of such lamps were in use, whereas in 1912 and 1913 respectively the totals rose to 10,727 and 37,823. During the year eleven types of safety lamp were tested by the Home Office, of which only two failed to pass the tests, and it is mentioned in the report from this department that one lamp has been approved which carries a gas-testing device, but the Home Office expresses no opinion as to the efficiency of this device. (See ELECTRICAL ENGINEERING, Dec. 3rd, 1914, p. 618.)

These lamps are distributed about the districts as follows:—Scotland, 1,160; Northern, 6,662; York, 25,004; Manchester and Ireland, 1,216; Liverpool, 385; South Wales, 2,716; Midland, 680. The makes of lamp used are:—Gray-Sussman, 10,283; C.E.A.G., 24,287; Oldham, 2,420; Wolf, 503; and other makes, 380.

SAFETY IN COLLIERY BELL SIGNALLING

IN the course of the investigations into the cause of the Senghenydd disaster, experiments were made by Dr. R. V. Wheeler, Chief Chemist to the Explosions in Mines Committee, showing the possibility of causing explosions of gaseous mixtures in certain circumstances by sparks from the ordinary system of signalling, by making contact between bare wires along a haulage road, and using unprotected bells. The matter has been gone into further, with the principle object of evolving a safe system, at the Laboratory of the Great Western Colliery Co.'s Coke Works, and the results of the experiments are contained in a Paper by Mr. T. G. Watts, published in the *Proceedings* of the South Wales Institute of Engineers. The same general method was employed, and the apparatus to be tested was introduced into a box filled with an explosive mixture of gases. The first experiments, with various mixtures, established the fact that coke-oven-gas and air mixtures are more easily ignited than methane and air mixtures, so that any apparatus shown to be safe in the coke-oven-gas mixture that was subsequently used was absolutely safe in methane mixtures. The possibility of ignition by the sparks from the contacts of an ordinary trembler bell as well as from sparks at the point of closing the circuit on the line was then demonstrated. A bell was next tried in which the contacts were shunted by a condenser, and it was found that the same bell which ordinarily produced ignition with four Léclanché cells produced no ignition when shunted by a condenser even with twelve cells. The author regards this method of protection as superior to attempts at rendering the bell flame-tight, especially those involving a vaseline-packed joint, as sometimes used. The condenser also lengthens the life of the bell contacts by eliminating sparking, and can easily be added to any bell.

Having thus proved the safety of the condenser shunted bell, the experiments were directed to applying the same remedy to the line contact. Here the condenser across the "knocking wires" did not eliminate the spark, but altered its character in a manner which prevented the mere bringing into contact of the two galvanised wires from causing ignition even with ten cells. When, however, contact was made with a file, ignition was produced by three cells. The provision of a condenser across the wires was therefore seen not to be a sufficient protection. An attempt was then made to lessen the current in the line wires by the introduction of a 10-ohm relay, but with three cells in the relay circuit ignition occurred, although the relay itself, with its contacts shunted by a condenser, had been proved safe. A 100-ohm relay was then tried, and six cells were required to produce ignition. As, however, this relay would work with two cells, even with

another 100 ohms in series with it, the author regards the margin of safety as sufficient with this system. The margin can be still further increased by putting a high resistance of some 2,000 ohms in shunt with the relay coils. This arrangement was proved to be safe up to ten cells, which is the maximum ever likely to be used in mine signalling of this character.

In the course of the discussion, Mr. H. Faraday Procter remarked that in addition to the vaseline clot bell which the author did not favour, there was another type on the market, in which a small spindle passed through a long hole and gave a quite flame-proof result. This rod was connected to the hammer, but only executed a rocking movement. The greater liability of the file contact spark to cause ignition was due to particles of metal disengaged. Still larger flashes were obtained with a sharp knife blade. He thought it would be sufficient to enclose the relay in a gas light case instead of shunting its break by a condenser.

ELECTRIC STEEL-MAKING FURNACES

A PAPER by Mr. T. D. Robertson on this subject was read before the Manchester Section of the Institution of Electrical Engineers on Jan. 26th. The first electric furnaces to work on a commercial scale were all constructed about 1899, viz., the Stassano furnaces in Italy, the Héroult in Savoy, and the Kjellin in Sweden, and from these three types the main classes now in use were developed. All of them used alternating current.

Broadly speaking, there were two classes of electric furnace—the induction furnace and the arc furnace. In the induction furnace, of which the Kjellin is an example, the metal bath is in the form of a ring-shaped trough forming the secondary of a single-phase transformer, with a rectangular iron core built into the furnace. This had certain disadvantages, which were overcome in the Röchling-Rodenhauser furnace (see ELECTRICAL ENGINEERING, Vol. IV., p. 17, July 2, 1908), with primary windings on both legs of the core surrounded by induction channels in the centre to form a working hearth of large dimensions. This middle part requires auxiliary heating, which is accomplished by a heavy secondary winding connected to plates embedded in the sides of the hearth. The larger furnaces of this pattern are constructed for three-phase working. Arc furnaces may be divided into arc radiation furnaces and arc conduction furnaces, according to whether the arc is between carbon electrodes only or between the electrodes and the charge itself. The Stassano three-phase furnace with its three inclined electrodes is an example of the former class which also includes the Rennerfelt two-phase furnace, with two horizontal and one vertical electrode. The earliest arc conduction furnace was that of Héroult. In its original single-phase form with two vertical electrodes, the current enters by one electrode, passes through the arc-gap, through the metal, and back through another arc to the second electrode. The position of the electrodes is regulated by motors acting through gearing and controlled by a Thury regulator. This furnace has the disadvantage of the surface of the charge being always hotter than the lower layers. The Girod single-phase furnace has one carbon electrode, and the current is conducted away from the charge by water-cooled iron studs embedded in the bottom of the furnace.

It was largely to get over the disadvantage of these studs and at the same time to obtain a furnace which will work from the usual supply mains through static transformers that the "Electro-metals" furnace was designed a few years ago. The original inventors were Messrs. Grönwall, Lindblad, and Stålhane, who developed the Elektrometall furnaces for the reduction of iron ores in Sweden. The development of their steel furnace has, however, taken place mainly in this country. Two-phase low-pressure current is obtained from a three-phase system through two "Scott" connected single-phase transformers. There are two upper electrodes, each carrying a separate phase, whilst in the bottom of the furnace beneath the basic lining is a third electrode which acts as a neutral return common to both phases. The lining, which is made of either dolomite or magnesite, is, when hot, quite a good conductor. If the pressure of each phase is 80 volts, there will only be a drop of about 3 volts through the lining. The heat developed by this is not wasted, as it serves to keep warm the lower portion of the furnace hearth. This two-phase arrangement gives rise to a certain amount of electromagnetic circulation.

The general construction of the furnace does not differ greatly from that of the other arc furnaces. The tank is made of steel plate suitably designed to avoid bulging when hot. The electrodes are held in steel holders carried on

horizontal arms, and fastened to a carriage which runs over and between two vertical channels. The carriage is driven by a vertical screw, and the worm gear by a small electric motor. The tilting gear is placed below and behind the furnace, and it is driven by a circuit motor. The roof, which is made of silica bricks, is held in a steel frame made separate from the furnace casing. The lining of the furnace is similar to that of most other furnaces, except that over the bottom plate there is a layer about $1\frac{1}{2}$ in. thick of carbon mixture, which when the furnace becomes hot is baked into a solid mass similar in composition and structure to the electrodes themselves.

The high-pressure electrical supply is taken to an isolating switch inside the high-pressure cubicle, and from this it is divided into two circuits, each of which passes to an oil switch, with auxiliary contacts for charging resistances, to neutralise the effect of any sudden loads on switching in. It is found in practice that a fairly high pressure, say 80 volts, gives the best results during the melting stage, but that as much less power is required for the subsequent refining, a lower pressure is desirable, as this gives much less wear and tear on the furnace roof and sides, especially during the latter stages of the process. In order to have these two pressures at the ready command of the operator, the switches are connected to tappings on the high-pressure side of the transformers, one tapping to give a high pressure of, say, 80 volts, and the other to give about 50 volts. These two switches are interlocked so that only one of them can be put in at one time.

The current is controlled by raising and lowering the electrodes. In small furnaces this adjustment is made by hand, but in the larger ones a motor is in conjunction with a Thury automatic regulator set to regulate the current on each phase at a definite figure. Direct control is also effected by drum type controllers, which, in conjunction with speed regulators, enable the electrodes to be quickly hoisted out of, or lowered down into, the furnace.

In addition to the melting of cold materials, electric furnaces are largely used for refining fluid metal taken from open-hearth furnaces or Bessemer converters, this practice being more common in America and on the Continent than it is in this country. In America there is a big field open for the electric furnace in the manufacture of even such common material as steel rails. In this country, concluded the author, the field for the electric steel furnace is mainly in the manufacture of tool and alloy steels, for making the smaller sizes of steel castings, and possibly in connection with the open-hearth and Bessemer plants for producing a superior product. Abroad, however, especially in those regions where water power is plentiful and electrical energy can be produced very cheaply, it is possible, in fact probable, that electric furnaces will be used to produce steel in large quantities instead of employing the older class of fuel-fired furnaces.

ELECTRIC MINERS' LAMPS IN AMERICA

AFTER investigating a number of patterns, the American Bureau of Mines has approved three electric lamps for use in fiery mines. One is the C.E.A.G. lamp, well known on the Continent and in this country, and the other two, known as the "Hirsh" and the "Wico" lamps, are designed to be worn in the miner's cap and connected to their battery by flexible leads. Both of these are of the bull's-eye pattern with parabolic reflectors, and are provided with devices for extinguishing the lamp on breakage of the outer glass. The Bureau has put forward a specification for electric miners' lamps for discussion and criticism, of which the following are the main points:—Intensity of light at all times, 0·4 candle-power. Flux of light at all times: for hand lamps, 30 lumens; for cap lamps, 1·5 lumens. Time of burning per charge, 12 hours. Average life of bulbs: for primary batteries and acid storage batteries, 300 hours, for alkaline storage batteries, 200 hours. Variation in current consumption of bulbs, 10 per cent. above average. Variation in candle-power of bulbs, 15 per cent. below average. Average life of batteries: for primary batteries and acid storage batteries, 3,600 hours; for alkaline storage batteries, 7,200 hours. Angle of reflector, 130°.

Mining and Metallurgical Patents.—No electrical patents specifications relating to mines have been published by the Patent Office during the last month. An electrometallurgical specification is No. 1,437/14 of E. F. K. Harbeck and B. Läu (Sweden), which describes a method of producing a malleable form of electrolytic iron, using an electrolyte consisting of a solution of an iron salt of hydrofluoric acid or hydrofluosilic acid is used, with no other metal in the solution.

PREVENTION OF BREAKDOWNS IN COLLIERY ELECTRICAL PLANT

A PAPER on this subject by Mr. Llewellyn Foster has recently been read before the Lancashire Branch of the Association of Mining Electrical Engineers. Generally speaking, said the author, breakdowns of mining electrical plant may be divided into three classes:—(1) Those caused by lack of attention and care, including want of systematic periodical opening out of the machines for inspection, cleaning, and overhaul. It is very seldom that we find any system of periodically taking machines apart for overhaul, or that the windings receive a coat of varnish except after repair. If the windings were kept clean and varnished occasionally a number of breakdowns would be prevented. (2) Those due to the machines being quite unsuitable for their work and situation. In mining work particularly, open or protected-type machines are often used when they meet the requirements of the Regulations, whereas, on account of the surrounding dust and dampness, the enclosed type, with separate fans, or preferably pipe-ventilated (if it is possible to use them) should have been used. (3) Those due to faulty design, defective material and workmanship. There are many machines with poorly-designed bearings, which allow the oil to creep on to the windings, where, as a consequence of its mixing with dust, surface leakage takes place and breakdowns occur.

One of the most frequent sources of trouble on alternating-current electrical plant in mines is due to the fact that a machine is left running as a single-phase owing to one of the three fuses having melted. A considerable proportion of breakdowns occur on the commutating parts of continuous-current machines, viz., commutators, brush-gear, &c., and sparking at these parts does not receive the careful attention it requires. Some of the causes of sparking are wrong position or unequal spacing of brushes, unsuitable brush thickness, and bad fit of the brushes in their holders. In this connection aluminium is spoken of as being a better material than brass for the brush-box on account of its lower coefficient of expansion. The condition of the insulation between the commutator bars has also to be carefully attended to. Fractured conductors and commutator connections and flats on commutator bars are mostly due to vibration, and through consequent chafing and pounding of the insulating material "earth" faults are caused. Knocking and jarring are due often to loose pulleys, pinions, and couplings on the driving or driven shafts. Regular measurements of the radial air-gap should be taken and recorded, as well as the test of lifting the shaft in its bearings.

On some colliery plants, where originally protected-type motors were installed, these have been converted into totally-enclosed machines, but without any reduction of the load. In one case this resulted in the solder melting out of the commutator spokes, the commutator being badly burned, but the machine was kept at full power until it broke down. This unsatisfactory condition of affairs could not be ascertained until the motor was opened out to localise the cause of the trouble. The reduced rating of a motor when totally enclosed is often lost sight of by the manager, and he is usually responsible for having the motor made totally enclosed.

The switch blades and contacts of the stator circuit, and the fuse fittings and contacts require regular and systematic examination. All ends of cables, connections, &c., should be soldered to prevent the danger of the machine running on incomplete phases. The satisfactory storing of spare parts, armatures, and such like is also a matter that requires careful arrangement, as the life of a part practically depends on this. Some pits are naturally very wet, and breakdowns frequently occur through dampness percolating into the windings of the motors and to the starting gear. In order to comply with the Home Office Regulations, the colliery mechanical engineer or his assistant is supposed to periodically examine all machinery above and below ground. If this rule was strictly enforced, the percentage of electric breakdowns would undoubtedly be reduced.

AN ELECTRICALLY DRIVEN ROLLING MILL

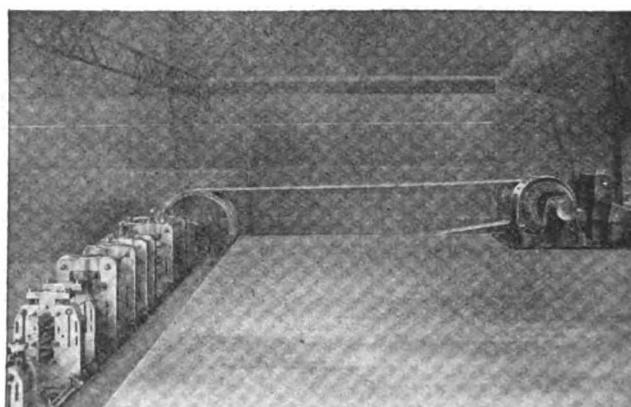
A LARGE firm of Birmingham steel workers, finding that their business had increased so rapidly that the existing plant could not cope with it, decided to lay down a new 10 in. electrically-driven mill for rolling steel ingots down to various small sections such as bicycle rims, &c. A general view of the rolling mill, with the driving motor, is shown in the figure. The motor, rated at 350 h.p., is of the "Witton" three-phase induction slip-ring type, and is started through

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a G.E.C. dust-tight liquid starter. Power is supplied by the Birmingham Corporation at 5,500 volts three-phase. It passes to a G.E.C. mistake-proof boiler-plate motor-control panel. In addition to the usual gear, this panel contains a set of choking coils to protect the end turns of the induction motor at the instant of switching on. The mill consists of one set of three-high pinions gearing down on to four sets of three-high rolls and one set of two-high rolls. The drive from the motor is by cotton ropes on to a 7-ton flywheel carried on a shaft running in self-oiling dust-proof bearings.

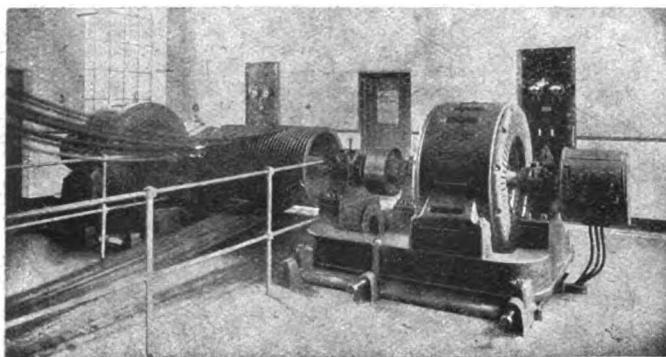


ROLLING MILL DRIVEN BY THREE-PHASE MOTOR.

A special feature of the installation is that provision is made for the easy adjustment of every part which can possibly require it, and everything is done to facilitate the changing of the rolls when this is required. The mill, which is one of the latest examples of this type, was built by Thos. Perry & Sons, Ltd., of Bilston, and the whole of the electrical equipment was supplied by the General Electric Co., Ltd. (of Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.). The photograph was taken at a time when the motor was not housed in, but in actual operation it is totally enclosed by a suitable erection.

ELECTRICALLY DRIVEN COLLIERY FANS

A COLLIERY ventilating fan installation which presents points of interest has recently been laid down at the Deep Navigation Colliery, of Ocean Collieries, Ltd.; at Tre-harris, South Wales. In this installation two motors have been installed, each of 300 h.p., driving a centrifugal fan in tandem. The present requirements of the colliery only call for one 300-h.p. motor, but by installing two similar motors, each capable of meeting the present requirements, but together adequate for the ultimate requirements of the colliery, it is possible to operate the motors economically now, and at the same time have a stand-by. When the requirements of the colliery increase up to the anticipated maximum of 600 h.p., the difference in efficiency between the two 300-h.p. motors and the one 600-h.p. will be comparatively negligible, while at those times when it is desired to cut



MOTORS DRIVING VENTILATING FANS.

down the ventilation of the colliery one 300-h.p. motor can be utilised when operating at its maximum efficiency. A view of the motors is given in the figure, from which it will be seen that the motors are mounted on a combination bed-plate with the rope driving pulley and shafting independently carried by pedestal bearings. Between each motor and the pulley a coupling is fixed, and by the removal of a small distance piece between the two holes of the coupling either motor can be disconnected. The motors are of the standard "Witton" three-phase pattern for 2,300 volts, 50 cycles. They have wound rotors with short-circuiting and brush-lifting devices. The pulley is 38-in. diameter, and takes 30 ropes each of 1½-in. diameter. For controlling the motors standard "Witton" boiler-plate cubicles were installed, as seen in the illustration. The electrical plant was supplied by the General Electric Co., Ltd. (Witton and Womanby Street, Cardiff, &c.).

SWITCH AND TRANSFORMER OILS

THE Research Committee of the Institution of Electrical Engineers recently appointed a Sub-Committee to investigate the properties of switch and transformer oils, and to consider the advisability of standardising oil tests. In order to obtain information on the subject, a circular letter was issued putting forward nineteen questions to manufacturing firms and research laboratories. The answers to these have been collated and reported on by Mr. W. Pollard Digby. His report appears in the Journal of the Institution. Many of the questions related to sludge formation. It is generally agreed that sludging is purely a chemical phenomenon, and is due to oxidation by the air forming certain complex organic compounds. The liability of an oil to sludge can be estimated by a short period test in which ozone is employed as an oxidising agent instead of air, and with different oils the amount of sludge produced varies from 0·6 to 20 per cent. It is believed that by keeping air entirely away from the oil, sludge formation would be completely prevented. The tendency to its formation is accelerated by increase of temperature, but no amount of cooling can reconvert the sludge into oil. A good deal depends on the degree of refinement of the oil, and grades of oil are known which show no sludging up to 160° F. The formation of sludge does not appear to have much effect on the electrical properties of the oil, but, as is well known, the absorption of moisture has a very deleterious effect, and its presence is more easily revealed by electrical than by chemical tests. A suggested standard of quality in this respect is a specific resistance of 200,000 megohms per c.c., and a dielectric strength of 10,000 volts between a needle point and a disc ½ in. in diameter, 100 mils apart. Another matter discussed

is the methods of testing the capacity of oils for thermal transference, and the carbonising effect of an arc in switch oils.

Diesel Engine Users' Association.—At the last meeting of this Association, the question of the use of Mexican fuel oil was discussed, and letters were read from several firms or undertakings who had used this class of fuel. A report on the influence of sulphur in liquid fuels used in internal-combustion engines was also referred to. The question of the Admiralty specification for fuel oil was discussed, and the Committee of the Association were requested to collect further information on the subject of specifications for this class of fuel with a view, possibly, of eventually preparing a standard specification. Mr. G. Porter (of Worthing) had prepared some notes on the subject of Diesel engine insurance, and it was suggested that the insurance offices should be approached with a view of discussing with them the whole question of insurance against breakdowns, for which a wide variation in rates obtains at the present time. The next meeting is to be held on Friday, Feb. 19th, at the Institution of Electrical Engineers. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, at 19 Cadogan Gardens, London, S.W.

Advanced Lecture Courses.—A special advanced course of lectures on "Design of Alternating-Current Turbo-Generators" will be given by Prof. Miles Walker at the City and Guilds (Engineering College), South Kensington, commencing Wednesday, February 10th. Another course on "Design, Manufacture, and Uses of Transformers," by Mr. A. P. M. Fleming, will commence on March 4th. Full particulars can be obtained from the Registrar.



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THE FUTURE OF LONDON'S ELECTRICITY SUPPLY

The L.C.C. Scheme Defeated

THE London County Council electric power scheme was defeated at the meeting on Tuesday on a vote upon a report of the Parliamentary Committee recommending that the previous decision of the Council to promote its electric supply bill be confirmed. This vote was necessary under Section 4 of the Borough Funds Act of 1872. Voting was not on strictly party lines, as a considerable number of Progressives, although not satisfied with the scheme, because it was not a purely municipal one, voted for it in the interests, as they believed, of Greater London generally. Under the Borough Funds Act it was necessary that there should be an absolute majority of the Council in favour of the Bill, and this meant that there must be 69 votes in favour of it. On a show of hands, however, only 60 were in favour, and on the subsequent division, 61 votes were recorded in favour of the scheme, and 32 against. It cannot, therefore, be proceeded with this session.

The arguments now put forward by those who voted against the scheme—many of whom voted in favour of it when it was before the Council on the last occasion—were mainly that in view of the serious opposition now threatened by the Borough Councils these members felt that they could not sacrifice their principles and again vote for a non-municipal scheme. It was further contended that although the technical side of the scheme had been most thoroughly gone into and evidence had been taken from Birmingham, Glasgow, Chicago, and Berlin—the witnesses including Sir John Snell and Dr. S. Z. de Ferranti—the administrative side had been dealt with in a most perfunctory manner. Indeed, it was suggested by Mr. Percy Harris that the whole of the details had practically been worked out during a week-end by the L.C.C. Engineer, who at the same time had his thoughts engaged by main drainage and other schemes, by the Controller, and by Mr. C. H. Merz, the Council's consulting engineer. These gentlemen had not had a free hand, but provided a scheme according to instructions. Mr. H. H. Gordon (Stepney) suggested that the scheme should be reconsidered apart from its technical aspects. The whole basis of it was wrong, for whether a London Borough Council took power in bulk from the new Authority or not they would have to share in any deficiency rate which might have to be levied. The essence of any good scheme must be consolidation. Alderman Mills (Progressive), who was for some time Chairman of the Islington Electricity Committee, was in favour of the Bill going forward, and suggested that no scheme put forward by the L.C.C. to deal with this problem would ever be accepted by the Borough Councils who, for the most part, were strongly of the opinion that nothing could be done better than they were doing themselves. The pride of Stepney, he said, was its electricity undertaking, and the glory of St. Pancras was its turbines, and if anybody waited for the time when a piece of legislation promoted by the L.C.C. received the benediction of a Borough Council, they would have to wait a very long time. Sir John Benn suggested that the Companies were strongly opposed to the proposed Technical Committee.

The members of the Moderate Party, on the other hand, appealed to the Progressives not to take up an uncompromising attitude in this matter, and to let the Bill have the benefit of a Parliamentary inquiry where, if it possessed all the demerits which had been suggested, it would meet with the fate it deserved. It was frankly put to the Progressive Party that the Moderates did not anticipate being able to secure the attendance of sufficient members to carry the vote, owing to so many of them being away on active service, but in reply to this it was suggested that if the Moderate Party as a whole had not been put under a pledge to support the scheme, a good many members of that Party would either not vote at all, or would vote against it. The point was further emphasised, by the Moderates, that the defeat of the Council's scheme would leave the Companies' Bill in full possession, and that it was doubtful whether the L.C.C. would carry much weight before the Parliamentary Committee which dealt with that proposal.

In the end, however, the scheme was defeated as mentioned above.

Previous to the above debate, Mr. Johnson asked the Chairman of the Electricity Supply Committee how many Borough Councils owning electricity undertakings had intimated their intention to support the Bill; how many not

owning electricity undertakings had done likewise; how many existing railway and traction companies had approached the Council regarding the possibility of their taking a supply in the event of the Bill becoming law, and what negotiations had been carried on with any company, body, or person with a view to their being constituted the operating company under the Bill. Mr. G. H. Hume said that with regard to the first two questions, it was not the practice of Metropolitan Borough Councils to intimate their intention to support Bills promoted by the L.C.C., neither was it possible at this stage for railway and similar companies to approach the Council. As to the last question, negotiations had been opened with practically all the London companies in different groups with a view to one of these groups being constituted the Operating Company, and these negotiations were still going on.

A comprehensive and detailed report had previously been issued by the Conference of Metropolitan Boroughs owning electricity undertakings. Most of the arguments put forward have already been noted in our columns. In regard to the suggestion in Messrs. Merz and McLellan's report, however, that by 1920, under the new scheme, an average saving of 34 per cent. will be possible on the prices ruling in 1911, it is pointed out that between 1902-3 and 1911-12 the price of electrical energy has fallen by 43 per cent., and the inference is that by continuing under present conditions a greater saving will be effected by 1920 than is estimated by the L.C.C. Attention is also called to the fact that no mention is made in Messrs. Merz and McLellan's report to the fact that municipal undertakings in London are supplying energy for heating and cooking at a uniform charge of 1d. or even less per unit, nor that the extended use of electrical energy for these purposes depends primarily on the cheapening of the necessary apparatus.

On the financial side, importance is laid upon the suggestion that the necessary capital for the scheme can be borrowed at 4 per cent. This is regarded as impossible, and that the figure would be at least 5 per cent. Taking this as the basis, it is shown that instead of estimated surpluses in 1920 of £20,000 and in 1925 of £97,000, there will be deficits of £121,000 and £183,000 respectively. Particular stress is laid upon the periods for repayment of loans. Authorised distributors are now allowed by the County Council 25 years for cables and 15 years for plant and machinery, but the L.C.C. proposes to allow 40 years and 25 years respectively to the new Electricity Supply Authority. If, says the report, the L.C.C. will treat the newer capital of the existing authorities similarly, many of them will be prepared to reduce their charges at once by 20 per cent.

Finally, it is suggested that equally good, if not better, results could be obtained by compulsory linking-up and co-operation under the Electric Lighting Acts of 1908-9, instead of allowing the powers under these Acts to remain entirely permissive. At the same time, the financial policy of the L.C.C. with regard to loans is held responsible for holding back progress in the past. With more lenient annual capital charges a large extension of linking-up between various stations would result both with municipal and company undertakings.

The attitude of the London Borough Councils owning electricity works was well summed-up in a letter in the *Evening News* of Monday by Mr. J. Horace Bowden, General Manager of the Poplar Electricity Works. In this he stated he would be prepared to advise his Council to withdraw all opposition to the L.C.C. Bill if it were modified to allow existing undertakers to continue as at present, with power to link up with other undertakings so long as the local cost of production is cheaper than would be the case if energy were purchased from the bulk supply authority; that no restrictions were placed upon extensions to existing stations or distributing mains; that similar periods for the repayment of loans as were proposed for the new authority should be allowed; and that local authorities should be permitted to claim exemption from the rateable area for which it was proposed to levy rates for any losses incurred by the new authority.

Technical Scholarships.—The London County Council are prepared to award 15 scholarships for full-time day instruction and a number of exhibitions for evening instruction tenable at technical institutes, &c. Applications must be sent in before Feb. 27th on forms obtainable from the Education Officer, Victoria Embankment, W.C. Full particulars are given in the L.C.C. Scholarship and Training of Teachers Handbook (price 1d., post free 3d.).

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Jan. 28th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

15,879/13. Radiators. P. R. WILDE. A radiator of the lamp type, provided with a water reservoir in the lower part and a series of wicks, one behind each lamp, to humidify the atmosphere. This radiator was described in ELECTRICAL ENGINEERING, Aug. 30th, 1914, p. 245. (Nine figures.)

22,575/13. Fuses. V. HOPE. Porcelain handle replacement fuses, in which the fuse wire passes through an oblique hole in the porcelain body of the fuse carrier, and the handle is well shielded from the fuse. This fuse, which is known as the "Fluvent" fuse, was described in ELECTRICAL ENGINEERING, Dec. 10th, 1914, p. 634. (Seven figures.)

24,274/13. Fuses. V. HOPE. This specification describes a method of assembling the above fuses to form distribution boards by threading the bases on a circular bus-bar, about which they can pivot independently to facilitate connecting up or inspection. (Ten figures.)

73/14. Electric Steering Gear, &c. W. H. SCOTT. This system of applying electric power to supplement hand power is applicable to steering gear, lock gate and sluice opening, and a number of purposes. A coupling allowing of a certain amount of slack is provided between the controlling hand wheel and the work, and contacts are provided, so that one set are closed when the drive is in one direction, and another set when the drive is in the other direction. These contacts, acting through suitable relays, &c., start the motor in the direction to assist the motion, and the motor runs as long as the movement is followed by the hand wheel. As soon as the motor begins to overrun, the contact is opened and the motor stops. The drive is through a centrifugal or other clutch, which leaves the motor disconnected when it does not start up owing to failure of current, so that the hand gear can be used alone. (Four figures.)

194/14. Enhancing Permeability of Iron. E. WILSON. In view of the fact that the permeability of iron for small magnetising forces is greater if it has not been previously subjected to a certain degree of magnetisation, it is suggested in this specification to enclose the iron in a case of magnetic material to shield it from the earth's field during preliminary demagnetisation or heat treatment. This applies, in particular, to cores of Pupin coils and the travelling bands of magnetic detectors. (Five figures.)

Specifications Published To-Day.

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS AND TRANSFORMERS: RILEY [Motor control] 17,038/14.

Electrometallurgy and Electrochemistry: DETTIFOSS POWER CO. and LIDHOLM [Cyanamide furnace] 28,629/13; B.T.-H. CO. (G.E. Co., U.S.A.) [Coating metals with zinc] 9,367/14; MILLS (Hanson & Van Winkle Co.) [Electroplating] 14,358/14; MACHALSKE [Furnace electrodes] 15,456/14.

Heating and Cooking: HAWKES [Heating elements] 7,145/14.

Incandescent Lamps: B.T.-H. CO. (G.E. Co., U.S.A.) [Incandescent lamps] 5,456/14.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within

Storage Batteries: SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGRER [Accumulator cells] 123/14.

Switchgear, Fuses and Fittings: VETTER [Lamp holders] 24,422/13; CRAVEN BROS., LTD., GARNER and HORROCKS [Limit switches] 29,366/13; HORSTMANN, HORSTMANN, HORSTMANN, HORSTMANN and EDGAR [Clock switches] 415/14; MASCARINI and CONTARDI [Resistances] 590/14; GREENE [Switches] 1,008/14; B.T.-H. CO. (G.E. Co., U.S.A.) [Controller locks] 3,217/14.

Telephony and Telegraphy: DERRIMAN (Automatic Enunciator Co.) [Telephones] 28,838/13; PFANNENSTEHL [Tape transmitter] 10,364/14; MARKS (Canadian Independent Telephone Co.) 11,564/14; JENSEN and PRIDHAN [Telephone set] 12,656/14; KESSELS [Telegraph receiver and keyboard transmitter] 13,018/14.

Traction: WILSON [Car lighting] 27,542/13; MIDGLEY and VANDERVELL [Car-lighting dynamo] 1,341/14; TAUNTON and ELECTRO-MECHANICAL BRAKE CO. [Trolley wheels] 6,652/14.

Miscellaneous: SOC. ANON. DES AUTOMOBILES ET CYCLES PEUGEOT [Transport of searchlights] 11,084/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: ALLMANA SVENSKA ELEKTRISKA AKTIEBOLAGET [Motor speed regulation] 22,732/14.

Miscellaneous: GES. FÜR ELEKTRO-OSMOSE [Treatment of materials for impregnating them electro-osmotically] 21,190/14.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

2,490/01. Storage Batteries. T. A. EDISON. This is one of the original patents for the Edison alkaline storage battery, and covers the use of electrodes of hydrated oxide of nickel or cobalt in a closed container and oxide of iron. An early form of construction of plate is described, and one of the claims is for mixing graphite with the active material.

2,607/01. Transformers. A. F. BERRY and THE BRITISH ELECTRIC TRANSFORMER CO., LTD. Transformers with the cores of radially arranged bundles of strips constructed with several magnetic circuits to form self-contained polyphase transformers.

2,834/01. Telegraphy. F. G. CREED and W. A. COULSON. Improvements in high-speed automatic transmitting and receiving instruments, whereby the movements of the sending and receiving strips are synchronous.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: W. MATTHIESSEN [Flame arc lamps] 22,631/06.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. CO. (G.E. Co., U.S.A.) [Voltage regulation] 23,415 and 23,416/09.

DYNAMOS, MOTORS AND TRANSFORMERS: M. MILCH [Control of induction motors] 22,863/06; SIEMENS BROS. DYN. WKS. (Siemens Schuckert) [Commutation system of rotary converters] 23,291/09.

Electrochemistry and Electrometallurgy: T. A. SMITH and T. DEAKIN [Electroplating] 21,687/08.

Ignition: R. J. ISAACSON [Ignition] 23,177/09; A. S. J. CHAPMAN [Ignition] 23,319/09; H. L. DOWN and TELEPHOS, LTD. [Lighting and extinguishing gas lamps] 24,309/09.

Batteries: H. F. JOEL [Primary cells] 22,547/06; H. LEITNER [Secondary cells] 22,807/06.

Switchgear, Fuses and Fittings: O. A. MYGATT [Prismatic lamp globes] 20,635/01; SIEMENS BROS. DYN. WAS. (Siemens Schuckert) [Cartridge fuses] 22,106 and 22,108/02.

Miscellaneous: F. DESSAUER [Roentgen ray apparatus] 23,455/09.

seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,428.

A 200-volt, single phase, 10-amp., 41·5 period meter is fixed to register the consumption of a double wire 200-100-volt trans-

former. As the supply is 200 volts, 83 periods, how will this affect the reading?—J. M.
(Replies must be received not later than first post, Thursday, Feb. 11th.)

ANSWERS TO No. 1,426.

In a turbine-driven 25-kw. direct-current dynamo running at 5,000 r.p.m., it is observed, when running up, that there are several periods before the armature reaches top speed when undue vibration occurs. This vibration does not continue, but comes at intervals, whilst the machine is increasing in speed. What is the cause and remedy? In machines of this class, what is the best method of trueing commutators which are uneven due to wear?—R. W. S.

The first award (10s.) is made to "M" for the following reply:—

The vibration observed by the questioner when starting up the turbo-generator is due to the speed of the machine corresponding with the natural period of vibration of the armature shaft. This vibration will always occur whenever this particular speed—called the critical speed—is attained, and will pass off as the speed changes. It will also take place, or tend to take place, whenever the speed attains a value which is a multiple of the critical speed. The only remedy is to stiffen the shaft to such an extent that its natural period of vibration is well above the normal speed of the machine. There are, however, practical difficulties in the way of this, and it is usual for manufacturers to design high-speed machines of this type, so that the normal speed falls midway between two critical speeds to insure smooth running. There is no real danger in vibration such as referred to above provided it does not become excessive; it is, however, a wise precaution to bring the speed up quickly past the critical point, and on no account allow the machine to run at the critical speed for any length of time. It is a mistake to make the bearing brasses of high-speed machines too tight, because when vibration occurs the shaft whirls slightly, and unless there is sufficient clearance in the bearings to allow the shaft to temporarily take up a slightly curved formation, undue strains will be set up.

In reply to the last paragraph of the question, the best method of trueing up the commutator of the machine referred to is to grind it, making use of one of the various commutator grinders on the market. If this is not obtainable, and a sufficiently large lathe is available, then the armature may be removed and turned. Care must be taken to use a very sharp tool and light cut, to avoid tearing the copper and bridging the gap between the segments.

The second award (5s.) is made to "A. G. R." who writes as follows:—

The cause of "R. W. S.'s" trouble is undoubtedly due to the "whirling" of the shaft when passing through its critical speeds. When a loaded shaft is rotating, the centre line of the shaft will not coincide absolutely with the axis of rotation owing to the load, the weight of the shaft, want of stiffness, vibration, &c. Hence centrifugal forces due to inertia will produce a bending moment on the shaft, tending to deflect it, and increased deflection will result in increased centrifugal forces. These forces are proportional to the deflection and to the square of the speed, and are resisted by the elastic forces of the shaft. As the speed increases, a value will be reached at which the centrifugal forces will exceed the elastic forces, and instability will result; this critical speed at which instability sets in, and the shaft whips out of centre, is called the *whirling* speed of the shaft. If, when the whirling of the shaft occurs, the speed is increased, the shaft will not tend to become more unstable, but the vibrations will die down and normal conditions will again be restored. There is an infinite series of whirling speeds, but, even with turbines, the second is very rarely reached, though the first is often passed through before normal speed is reached.

As long as the second whirling speed is not reached (and it is generally far removed from the first), I do not think that "R. W. S." need worry. Of course, the only remedy is to increase the diameter of the shaft, or, if possible, reduce the distance between the bearings.

With regard to the methods of trueing commutators, only the two most common methods need be mentioned:—(1) That employing a turning tool, (2) that employing a grinding tool. In this case it is assumed that this is required to be carried out without uncoupling the machines. The apparatus for the first method consists of a simple tool post for holding the cutting tool, mounted on suitable ways and fitted with a cross-feed screw. The tool must be mounted very rigidly to prevent chattering, and a cutting speed of 550 feet per minute has been found best. Unless such a tool is operated

by an expert, too much may be turned off before a satisfactory job is obtained. Also few commutators have a normal peripheral speed as low as the cutting speed required. A rotating grinding wheel, so arranged that it can be fed backwards and forwards by means of a lead screw, constitutes by far the best arrangement in this case. The advantages of such a tool are that the minimum amount of copper is removed, a perfect cylindrical surface is obtained, and the work may be done with machine at full speed. The success depends upon the tool being rigidly supported and having closely fitting bearings so that no vibration occurs. Grinding is probably slower than turning, but it undoubtedly gives a better surface.

ANSWER TO CORRESPONDENT

L. R.—Your reply to No. 1,426 is in many ways excellent, but "in judging the replies, importance will be attached to clearness and conciseness, as well as accuracy."

TELEPHONY AND TELEGRAPHY
(INCLUDING WIRELESS)

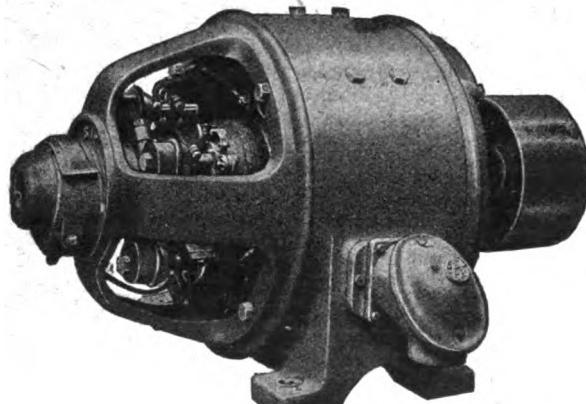
In a lecture on long-distance telephony, reported in ELECTRICAL ENGINEERING on April 2nd, p. 191, Prof. J. A. Fleming mentioned that the longest telephone line—from New York to Denver, some 2,000 miles—was being extended to San Francisco, a total length of 3,000 miles. It was announced in last Thursday's *Times*, by their New York correspondent, that this had now been accomplished, and that, in fact, other lines had been joined up with this one, as an experiment, and speech was transmitted over 5,000 miles. Congratulations over the wire were exchanged between the President of the United States (at Washington), the Mayor of San Francisco, the veteran Prof. Graham Bell, and Mr. Vail, head of the American Telephone & Telegraph Co. (at Jekyll Island, Georgia). While this may not yet be the limiting distance over which speech can be transmitted on "loaded" lines, yet it is premature to speak, as the *Times* correspondent does, of Transatlantic telephony being foreshadowed, although naturally the temptation is great, since the distance between New York and London is far less than 5,000 miles. That a cable between the two continents is not inherently impossible may be admitted, but the difference between cable and overhead transmission is so great that the problem will be an economic one long after it has ceased to be one presenting any scientific difficulties. It is useless to estimate the probable cost of such a cable until the great nations of Europe have been at peace for many years.

Mr. A. A. Campbell Swinton delivered his Presidential Address to the Wireless Society of London on Tuesday, Jan. 26th. This is Mr. Campbell Swinton's second year of office, and but for the war a new President would have been elected. He urged members to strictly obey restrictions at present placed upon wireless working. His own apparatus had not only been dismantled, but actually taken away by the Post Office, and he hoped all members of the Society would follow his example. As President of the Society he had been able to interest himself in one or two cases and obtain an alleviation of the very severe penalties incurred, where the offence was obviously technical and thoughtless. During the past few months the Society had been of some assistance to the Post Office, it having furnished a number of operators to that department. The number was not so great as might have been hoped, but the standard set was a very high one. Assistance had also been given in other directions, and the written thanks of the Post Office and Home Office had been received. At last year's meeting wireless messages were exchanged with the Eiffel Tower, but that was not possible this year. Col. Ferrié, however, had sent a cordial message, to which he proposed to send a suitable reply, congratulating him also upon his advance in rank from Commandant. Continuing, Mr. Campbell Swinton said that as he was debarred from demonstrating anything approaching wireless, he had thought of some of the old experiments which led up to wireless, and which twenty years ago excited widespread interest. The rest of the evening, therefore, was devoted to a demonstration of spinning eggs and balls in a magnetic field, a brief description of the history of the Leyden jar, and subsequent work by Tesla and Elihu Thomson on spark gaps, experiments showing the effects of self-induction, Crookes' tubes effects, and the Duddell musical arc.

"ELECTRICAL ENGINEERING" TRADE SECTION

A NEW LINE OF CONTINUOUS CURRENT MOTORS

WE have received from the British Thomson-Houston Co., Ltd. (Rugby), particulars of a new line of continuous-current motors, known as the DR. type, which they are introducing. This is of an exceptionally robust construction, and commutating poles are used throughout the entire range, enabling a very wide range of speeds to be secured by field control, and the practically entire absence of sparking ensures a long life of both commutator and brushes. The latter when once correctly set require no change in position for any fluctuation in load. The quality of sheet steel and insulating compound used in the laminated armature core and poles reduces hysteresis and eddy current losses to a minimum, and friction losses are minimised by the use of low-friction metal with ring lubrication. The magnetic structure is so arranged as to render the motors free from objectionable hum, and internal ventilation is provided by the back of the armature. The commutator is also provided with ventilating ducts. All these motors are designed for an overload capacity of 25 per cent. for thirty minutes, or a momentary overload of 100 per cent., and all protected, enclosed ventilated, drip-proof, and pipe-ventilated type motors will run for six hours with a temperature rise



NEW DESIGN OF CONTINUOUS-CURRENT PROTECTED TYPE MOTOR.

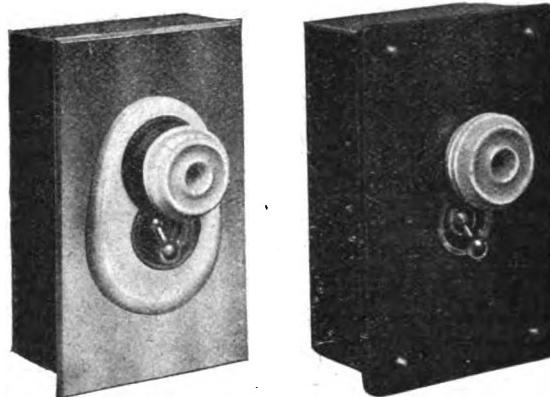
(measured by thermometer) not exceeding 40° C. (72° F.). All motors are subjected to a high potential test of 1500 volts A.C. for a period of one minute immediately after a heat run at the factory.

In the protected type the armature, field coils, and other live parts, are mechanically protected, while free ventilation is not impeded. The enclosed ventilated type has the end-shield openings further protected by perforated metal covers of not less than $\frac{1}{8}$ in. mesh, while in the drip-proof type all the openings are so protected as to exclude drops, splashés, falling chips, etc. The totally enclosed type has the openings enclosed with either sheet metal, or has solid cast-metal covers, a special commutator end-shield with machined joints being supplied for this purpose. In pipe-ventilated motors one of the solid covers is fitted with a flanged pipe intake. Motors can be readily converted from one type to another by a change of covers or end-shield; the bolt holes in the end-shields are so spaced that they can be turned through 90° or 180°, allowing the motor to be mounted on the floor, wall, or ceiling. The poles are bolted direct to the magnet frame in such a manner as to permit of removal, together with the field spools, without displacement of the armature. The leads are brought out of the motor casing through rubber bushes into a cast-iron junction-box, which is provided with screwed outlet for conduit wiring. A standard protected-type motor is illustrated here.

INTERLOCKING SWITCH-PLUGS

APATTERN of interlocked switch-plug mounted in cast-iron box for use on conduit installations has been introduced by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.). When the plug is inserted and the switch is in the

"on" position, the dolly lies over the extended flange of the plug, thus making it impossible to withdraw the plug without switching off. Similarly it is impossible to insert the

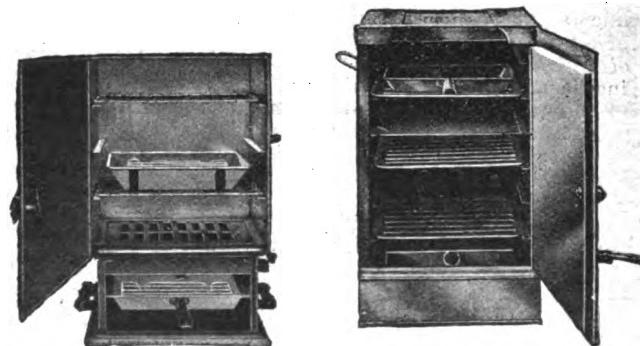


FLUSH PATTERN INTERLOCKING SWITCH-PLUGS.

plug whilst the switch is on. Two flush forms are illustrated, one with a black fibre cover and the other with brass and porcelain front. Hand-shield plugs can be used instead of the type illustrated.

ELECTRIC COOKERS FOR FLATS

WE illustrate here two patterns of inexpensive electric cooker which have been developed by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), to meet the need for an outfit that either can be hired out by the supply authority at a moderate rental or purchased by the consumer. They are both specially adapted for situations where space is limited. The set in Fig. 1 consists of a magnet hot-plate and griller of the pattern illustrated in ELECTRICAL ENGINEERING, Nov. 26th, 1914 (p. 613), upon which is mounted a bright sheet-steel oven giving a cooking space of 12 x 12 x 9 in. The heating element is just under the perforated top of the grill, and is arranged in two circuits taking 750 watts each. When no grilling is being



OVEN MOUNTED ON ELECTRIC GRILL.

OVEN WITH TOP AND BOTTOM HEAT.

done, a reflector plate is slipped in under the heater, directing all the heat up into the oven. The design of the hot-plate is such that an uninterrupted uniform current of hot air ascends into the oven. The oven in Fig. 2, which is made under Patent No. 17,688/13, is a self-contained piece of apparatus with heating elements both at the top and at the bottom, and is larger in sizes, having a cooking space of 15 x 12 x 12 in. The sub-division of the top and bottom heating elements and the use of series parallel grouping enables eight degrees of heating to be obtained with consumptions varying from 200 to 2,200 watts. The top heat can be used for grilling. This oven also differs from the other in that it has double walls with a still air-jacket between. Earthing terminals are provided on both models, which can be used if thought necessary.

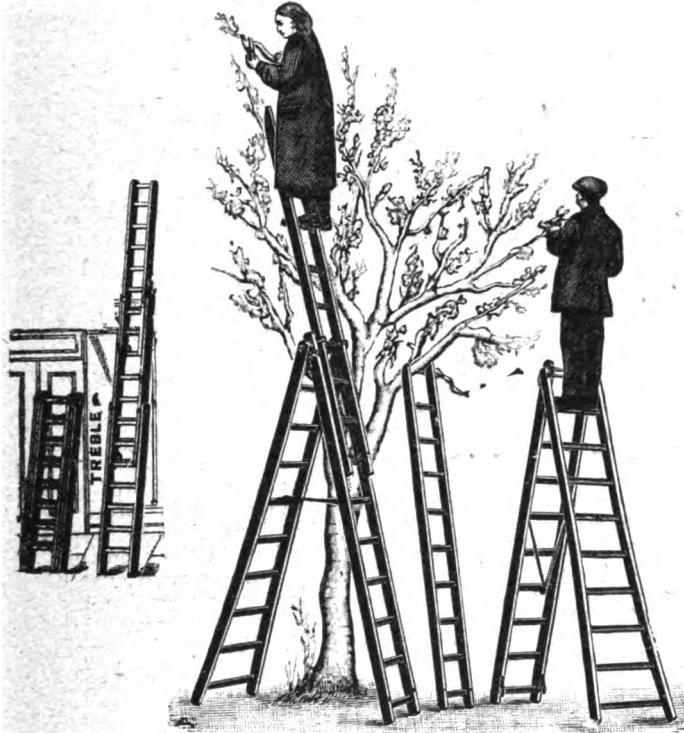
CATALOGUES, PAMPHLETS, &c., RECEIVED

IRONCLAD SERVICE FUSE BOXES.—It has been pointed out to us that the last sentence in our notice last week of the new catalogue of Ironclad service fuse boxes issued by W. T. Henley's Telegraph Works Co., Ltd., is liable to possible misconstruction. The boxes in question are all manufactured by the firm themselves, and what we wished to say was that all their types are not listed, as new designs are being introduced at such a rapid rate that it is impossible for any catalogue to keep pace with them.

CONCEALED LIGHTING.—A complete series of reflectors and fittings for use with tubular lamps, all most carefully designed to obtain a maximum useful efficiency by the distribution of the light exactly where it is wanted, has been issued by A. W. Beuttell, Ltd. (109 Victoria Street, S.W.). The range comprises strip fixtures for shop window showcase, and other concealed lighting, with various styles of trough reflectors, including a neat wood moulding strip, portable showcase, shop-window, and poster illuminating reflectors, desk lamps, ceiling lighting by light reflected on to specially curved diffusing surfaces, and theatre footlights. These fittings are covered by patent.

A CONVENIENT LADDER

WE illustrate here a new form of triple ladder which has been put on the market by J. H. Heathman (Parsons Green). As will be seen, the three ladders are



available for use separately or together, or can be converted into a self-standing trestle with or without extension. They are light in weight, although durable and strongly made.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Blackburn.—Twelve months' supply of motors, motor-starting switches, house service fuse-boxes, insulating material, &c. Borough Electrical Engineer. Feb. 13th.

Blackpool.—The Corporation proposes to apply for borrowing powers for £24,500 for electricity extensions.

Blackrock.—A L.G.B. inquiry was held last week concerning a loan of £13,000 for the Council's electric lighting scheme. Several members of the Council opposed on the ground that the scheme had not been sufficiently considered and that adequate expert advice had not been obtained.

Caerphilly.—A local electric supply company has just been registered with a capital of £6,000. The solicitors are Seymour, Williams & Co., 38 Parliament Street, S.W.

Haslingden.—A loan of £12,000 is to be sought for mains, services, transformers, and switchgear.

Limerick.—A Local Government Board inquiry was held last week into an application by the Corporation for a loan of £5,000 for additional plant at the power station.

Luton.—Extensions at an estimated cost of £27,000 are contemplated. Additional mains are also required.

Netherlands.—H.M. Consul-General in Rotterdam, says the *Board of Trade Journal*, reports a demand in the Netherlands for electric cable and wires. Communications to the British Consulate-General, Rotterdam.

Newcastle-under-Lyme.—L.T. feeders and distributors. Borough Electrical Engineer.

Rotherham.—Two water-tube boilers, mechanical stokers, economisers, superheaters, &c. Borough Electrical Engineer, Feb. 22nd.

Stockton-on-Tees.—Two 500 kw. rotary converters, transformers, and starting apparatus. Borough Electrical Engineer, Feb. 19th. (See an advertisement on another page.)

Walthamstow.—A loan of £14,590 is to be taken up for electrical extensions.

Wiring

Cardiff.—New technical institute, Cathays Park. Borough Electrical Engineer. Feb. 22nd.

Leeds.—Tuberculosis hospital. City Engineer, Feb. 10th. School. Education Architect, Feb. 17th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Ayr.—New school.

Burnley.—Extensions to Victoria Hospital (£25,000).

Dundee.—New school (£22,700). Architects, M'Laren, Sons & Soutar.

Fleetwood.—Police station, Wyre Dock (£4,000).

Littlehampton.—Isolation hospital. Council's Surveyor.

London: Stepney.—New municipal buildings.

St. Austell.—Technical school (£3,400).

Miscellaneous

Eccles.—The question of street lighting is receiving consideration.

Ireland.—The Midland Railway Co. requires six or twelve months' supply of telegraph material, electric lamps, carbons, &c. Secretary, York Road, Belfast.

London: St. Marylebone.—Stores for electricity department, including cable, insulating materials, flexible cord, etc. Town Clerk, February 17th. (See an advertisement on another page.)

Manchester.—General stores for tramway department. Chairman of Tramways Committee, February 16th. (See an advertisement on another page.)

Sheffield.—Twelve months' supply of electrical fittings for the Cleansing Department. Town Clerk. Feb. 13th.

Stalybridge.—The Joint Board's Electrical Engineer is making experiments in the lighting of workmen's dwellings.

Stockton-on-Tees.—Miscellaneous stores for various departments, Feb. 16th. (See an advertisement on another page.)

West Bromwich.—As a number of the Corporation's petrol omnibuses have been taken by the War Office, the purchase of four electric chassis is recommended.

York.—Six double-deck cars are required. Tramway Manager.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Manchester.—The Electricity Committee has accepted the following tenders:—Two 500 k.v.a. transformers, Johnson & Phillips; one 500 kw. motor converter, Bruce Peebles & Co.; cable and purchase of copper on behalf of Committee, British Insulated & Helsby Cables, Ltd.

Neath.—A twelve months' contract has been placed with the Electrical Apparatus Co., Ltd., for meters.

Messrs. J. Kaye & Sons, Ltd., inform us that since the war they have received orders from the War Office for 29,436 oil-cans, and that, without competition, the Admiralty has renewed its three years' contract, which ended in November last. In addition, the Navy has ordered 7,170 oil-cans and 6,228 patent seamless spouts since the war began.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £68 to £68 10s. (last week £66 10s. to £67).

New Branch.—Fife, Wilson & Co. (155a St. Vincent Street, Glasgow) have opened a London office at Broad Sanctuary Chambers, 11 Tothill Street, Westminster (telegrams: Ductility Vic. London; telephone: Victoria 6921), in charge of Mr. A. G. Tucker, for the sale of "Kelvin" petrol and paraffin engines, &c., generating sets, quarto-watt heaters, &c.

Liquidations.—A meeting of the creditors of the Altheat Co., Ltd., was held on Monday. The total liabilities are £370, and the value of the assets is estimated at about £207, in addition to two patents. Mr. Alfred Slatter, a director of the Company, is liquidator, and the meeting appointed Mr. E. H. Hawkins, of the Colebrookdale Co., the chief creditors, to act as joint liquidator.

Mr. E. T. Kerr, of 95 Colmore Row, Birmingham, has been appointed receiver for the debenture holders of the British Prometheus Co., Ltd., Salop Street, Birmingham.

APPOINTMENTS AND PERSONAL NOTES

Mr. Alexander Siemens, who, besides being a director of the Siemens companies in this country, is also a Past-President of the Institutions of Civil and Electrical Engineers and Chairman of the Engineering Standards Committee, has written the following letter to the Royal Institution, of which he is Secretary:—

"It has come to my knowledge that a short declaration on my part, with regard to my position as a British subject, and with regard to my sentiments about the war, would be acceptable to the managers of the Royal Institution. I, therefore, venture to lay before you the following statement:—I have been born in Hanover, both my parents having been British subjects until Hanover was separated from the United Kingdom in accordance with the provisions of the Salic Law. In the year 1866 the kingdom of Hanover was annexed by Prussia, and thereby universal military service was introduced. In July, 1867, I first came to England, and I went back to Germany in 1868 to absolve my military duties, but I was not accepted on account of my shortsightedness. I had, however, to present myself again, when the war against France broke out in July, 1870, and I joined a regiment of the Line for one year. In October, 1871, I returned to London, where I have resided ever since. As it became probable that I should spend my life in this country, I resolved to follow the example of the late Sir William Siemens by becoming a naturalised British subject. To carry out this plan I obtained my formal release from German citizenship in March, 1878, and my certificate of naturalisation (No. 2,671) was filed at the Home Office on August 16th, 1878. Thus I have been a subject of the kingdom of Hanover for 19 years, of Prussia for 12 years, most of which time I spent out of Germany, and of the United Kingdom for over 36 years, nearly all of which I spent in London. As a consequence my sympathies in this war are entirely on the side of the Allies, and I cannot express strongly enough my abhorrence of the way in which Germany has disregarded international treaties and conventions, as to the conduct of hostilities, and more particularly of the raids made on unfortified watering-places in this country. I should like to add that in return for the advantages I have enjoyed as a British subject, I have done my best to serve this country whenever an opportunity for doing so presented itself to me."

Mr. J. C. Williams, Deputy Borough Electrical Engineer and Tramways Manager at Rotherham, has been appointed Borough Electrical Engineer and Tramways Manager at Erith at a commencing salary of £350 per annum.

Mr. A. J. Cridge has accepted a position with the British Westinghouse Electric & Manufacturing Co., Ltd., and has taken up his duties at Trafford Park.

Mr. J. T. Wilson has been appointed agent to the Cremer Lamp & Engineering Co. for the London district at their office at 39 Victoria Street, S.W.

Mr. A. J. Beckett, Borough Electrical Engineer at Bridlington, has received a Commission in the Royal Engineers.

Particulars of positions for switchboard attendants, shift engineers, telephone engineers, &c., are given in our advertisement columns.

LOCAL NOTES

Accrington: *Staff and Enlisting.*—The Electricity Committee reports that several of the technical staff are desirous of joining the colours, but as their places will be extremely difficult to fill, the Council's opinion as to what course should be taken is asked.

Belfast: *Electricity Works Administration.*—On Monday the recommendation of the Tramways and Electrical Committee that Alderman Tyrrell, Alderman Finnigan, Councillor Duff, the Electrical Engineer, and the Town Clerk's Chief Assistant be appointed to visit Bradford, Sheffield, Leeds, and Greenwich to obtain information as to administration and other matters relating to the electrical undertaking, was approved.

Burnley: *Staff and Enlistment.*—The Electricity Committee has intimated to Mr. J. E. Starkie, the Borough Electrical Engineer, Mr. T. Taylor, the Assistant Electrical Engineer, and Mr. G. D. Clegg, Switchboard Attendant, their inability to consent to these gentlemen enlisting.

Erith: *Bulk Supply.*—A suggestion from the Woolwich Council that Erith should take a supply of electrical energy in bulk from it, has been deferred for the consideration of the new Borough Electrical Engineer, whose appointment is announced elsewhere in this issue.

London: *Woolwich: The Plumstead Power Station.*—Sir John Snell in his first report upon the working of the Council's electricity undertaking suggested that the Plumstead power house should be closed. He now recommends that this power station should not be shut down entirely, but should be continued in use by the destructor steam only, and be held ready for reserve purposes.

Maidstone: *Ljungstrom Turbine.*—A recommendation of the Electricity Committee that the Brush Engineering Co., Ltd., be asked to tender for a 1,000 kw. Ljungstrom turbo-alternator has been passed by the Council.

Price of Current.—Large consumers have been notified that, owing to the price of coal, it may be necessary to increase the price of current, presumably in accordance with the coal clauses in the contracts.

Wimbledon: *Shortage of Coal.*—A circular was issued to consumers on Tuesday, stating that, owing to difficulties in transport of coal, the electricity works might be compelled to restrict the output of electricity for all purposes at any time after midday yesterday. As a result of pressure on the L. & S.W. Railway Co. and the military authorities, the Corporation have obtained an assurance that in future they would receive regular deliveries of coal sufficient to keep the works running in the ordinary way; but, in the event of the Railway Co. failing to deliver this morning certain quantities arranged, the Corporation would have no alternative but to close the works. In consequence, there was a rush in the district for candles, lamps, and oil. Fortunately some deliveries of coal were obtained in time, but the works have still to rely on supplies from day to day.

Flexibles for Pendants.—In view of the greater stress put upon the flexible cords in many modern fittings than was the case formerly, the General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.), has decided to discontinue the use of flexibles with strands of Nos. 38 and 40 gauges, and always to use such a number of strands of No. 36 gauge as to give an equivalent section in solid copper.

The Society of Engineers.—At a meeting last Monday Mr. Norman Scorgie gave his Presidential Address dealing principally with municipal engineering. Among the premiums, &c., presented was the President's gold medal to Mr. A. S. E. Ackermann for his Paper in the utilisation of solar energy.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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SUMMARY

WE give some details of a scheme for linking up the Hackney and Poplar electricity undertakings (p. 56).

AN interesting preliminary point has been decided in the action by the British Thomson-Houston Co., Ltd., v. Duram, Ltd., regarding alleged infringement of a metal filament lamp patent (p. 56).

AT a recent meeting of the "Point-Fives," a discussion was held on electric supply for heating and cooking (p. 56).

A PAPER describing several types of polyphase commutator motor for variable speed and other work has been read by Mr. N. Shuttleworth before the Birmingham Local Section of the Institution of Electrical Engineers (p. 57).

A PAPER by Mr. T. R. Houston, read before the Rugby Engineering Society, dealt with some interesting points connected with surface condensing plant (p. 57).

AT a meeting of the London Branch of the Association of Mining Electrical Engineers on Friday, Mr. E. Kilburn Scott read a paper on lightning and surge protection (p. 58).

ALTHOUGH the actual shortage of coal is not so serious as it was, prices have risen greatly, and, if this is not checked, a general increase in the charges for electric supply may occur (p. 58).

A NUMBER of technical books are reviewed (pp. 58 and 59).

THE possible causes of unsatisfactory running in parallel of induction motor generators are discussed in our "Questions and Answers" columns (p. 59).

A PAPER read before the Scottish Local Section of the Institution of Electrical Engineers contains results of experiments on the heating of field coils (p. 60).

ATTEMPTS are being made to re-introduce the L.C.C. Electric Power Bill at a special meeting of the Council (p. 60).

THE causes of two recent runaway tramcar accidents are referred to in our Electric Traction Notes (p. 60).

A PAPER by Prof. E. W. Marchant before the Manchester Local Section of the Institution of Electrical Engineers contains results of an investigation into the conditions affecting the strength of wireless signals.—The stations for direct wireless communication between Norway and America are in an advanced stage of construction.—A few further particulars of the New York-San Francisco telephone line are given (p. 60).

AMONG the specifications published at the Patent Office last Thursday was one for the use of resistances with a negative temperature coefficient for starting induction motors. A B.T.-H. patent covers the thinning down of lamp filaments near the points of support to allow for the cooling effect. One of the Highfield booster patents expires this week after a full life of fourteen years (p. 61).

A NEW locking lampholder, an ironclad distribution board, a star-delta starter and a new design of searchlight are described in our trade section, which also contains an illustrated article on an interesting system of concealed lighting (pp. 62 to 65).

GENERATING plant is required at Redditch (£28,000); Walthamstow (£14,590); mains and services at Gillingham (£6,750); superheaters at Manchester; cable, mains, etc., at Hammersmith, Bootle, and Dewsbury; mains, transformer, and sub-station equipment at Worcester (£5,250) (p. 65).

THE Electric Lighting Companies in Westminster refuse to make a reduction in the charge on account of reduced lighting.—The War Office has commandeered generating plant from the Brush Company's Works intended for Batley, Kettering, and London.—The Wigan Electric Lighting Committee has rescinded a contract placed with a firm whose capital is largely held by Germans.—There is a large amount of opposition to the Yorkshire Electric Power Co.'s Bill (p. 66).

Arrangements for the week will be found on p. 66.

The Anglo-Norwegian Trade Journal.—This is a new publication, of which the first number has just been issued by the Norwegian Chamber of Commerce (44-46 Kingsway, W.C.). A quantity of information regarding supply, demand, facilities, and restrictions relating to trade between this country and Norway.

"LINKING UP" IN LONDON

THE Hackney and Poplar Borough Electrical Engineers have prepared reports with regard to linking up the two electricity undertakings which, if they can be acted upon, will result in Shoreditch, Stepney, Poplar, and Hackney being permanently interconnected. Already Poplar and Stepney have been giving one another reciprocal supplies in such a way that the Poplar plant has been entirely shut down from midnight until about 6 a.m. the following morning, and Mr. Bowden, Borough Electrical Engineer at Poplar, estimates that by being able to shut down his plant during the uneconomical night load he is saving over £400 per annum. Hitherto there have been certain circumstances which have prevented the Hackney and Poplar electricity undertakings being linked up, but with the completion of the Hackney new plant, recently described in our columns, and the laying of the E.H.T. ring main, the chief difficulties have been overcome. Certain heads of agreement have now been formulated, and it is suggested that either party shall supply energy to the other at the price of 0·25d. per unit without any fixed charges being paid. The period of the agreement is to be for twenty years, with revision of price by mutual agreement every five years. The cost of the necessary mains and switchgear for effecting the link is estimated at £2,720. The Hackney Electricity Committee recommends that the Town Clerk be instructed to confer with the Poplar Town Clerk with a view to drafting an agreement to be submitted to the Board of Trade later.

METAL FILAMENT LAMP LITIGATION

A COURT of Appeal, consisting of Lord Justices Buckley and Pickford, on Thursday had an interesting point to decide in connection with the patent infringement action now pending between the British Thomson-Houston Co., Ltd., and Duram, Ltd. In December, Mr. Justice Neville had before him an application by Duram, Ltd., for what is known in legal phraseology as "discovery" of documents. In other words, Duram, Ltd., claimed that, in order to be able to frame their defence to the alleged infringement, they should have access to certain documents of the British Thomson-Houston Co. The allegation in the defence is that the British Thomson-Houston Co. has not been adequately working the patent in question, namely, No. 21,518* of 1906, in this country, but that it is necessary that access should be given to documents in the possession of the British Thomson-Houston Co. to prove this. Generally it is alleged that the filaments under this patent have been imported by the British Thomson-Houston Co., Ltd., from America, Germany, and Holland, and the defence also includes an application under Section 27 of the Patent Act of 1907 for the revocation of the patent in question on the ground that the patented process is not worked wholly or mainly in the United Kingdom.

For the British Thomson-Houston Co. it was argued that this application by Duram, Ltd., was in the nature of a "fishing" application; in other words, an attempt to ascertain details of a competitor's business. Such an application, it was further contended, was within the discretion of the Court to deal with, quite apart from any regulations laid down under the Patent Act, and this discretion Mr. A. J. Walter, K.C., asked the Court to exercise on the ground that to grant Duram, Ltd., what they required would be oppressive.

Eventually the Court decided that Duram, Ltd., were entitled to the "discovery" of documents which would show the extent to which the British Thomson-Houston Co. has imported filaments from abroad, but that such discovery should not include any names of customers of the British Thomson-Houston Co. This decision, in fact, was in accordance with an offer made by Mr. Terrell, K.C., for Duram, Ltd., during the arguments.

Old Centralians.—In view of the fact that a very large number of members are at present serving with the Colours, while others are working at the highest pressure in order to ensure a maximum production of armaments and war stores, it has been decided that the annual dinner will not be held this year. For the same reason it has been decided to make no changes in the officers of the Association.

Iron and Steel Institute.—The annual meeting will be held at the Institution of Civil Engineers on May 13th and 14th, and the annual dinner is provisionally fixed for May 13th. It has also been decided provisionally to hold the autumn meeting in London during the week ending Sept. 25th next.

THE POINT FIVES

AT a meeting of the "Point Fives" on January 15th an address was given by Mr. H. Gray (Accrington), who urged that the energy of the Association should be directed to encouraging the heating load in shops, hotels, etc., as well as in private residences, and recommended a tariff based on a sliding scale of percentages on rateable value and a fixed price per unit. This would also, in his opinion, obtain a considerable additional lighting load in such premises. Referring to details of domestic appliances, he said that the hot bar "fire" was rapidly superseding the lamp radiator, largely because more kilowatts could be concentrated into a given space. He also described a church installation in which cold down draughts were entirely done away with by a ring of hot bar strips at a considerable distance from the floor taking 20 kw. With regard to cookers, he said that the fight between price and quality had been steadily progressing, and at present a thoroughly reliable article could be obtained at a reasonable price provided that all elaborations are excluded. A cooker built on similar lines to a gas cooker, of cast-iron, having removable fittings, with hot plate and grill on the top of the oven, and without circuit indicators, thermometer, and inspection window, etc., appeared to give satisfaction in the majority of cases, but for better-class work, where the customer would pay an increased price, useful elaborations were much valued. There was a tendency where there was room to have the griller and boiling rings removed from the oven and put on one side. The oven could, of course, in this case be raised to a more convenient height. The standardising of hot plates might present difficulties. The author was still of opinion that the radiant heat (red hot) plate would be ultimately the most satisfactory type. Rapid operation could never be effected if the heating element had to heat up an iron plate as a preliminary to the heat being passed on to the cooking vessel.

There was some difference of opinion expressed in the discussion as to whether the shop and hotel problem came within the objects of the Association, which, Mr. Pickvance (Wrexham) pointed out, were simply to foster the consumption of electrical energy for domestic purposes. Again, shop lighting did not need special aid for its development, nor any complicated system of charging to attract. Mr. S. T. Allen (Wolverhampton) was also against applying the rateable value system to shops, and Mr. Shaw (Ilford) thought that the maximum demand system was most suitable. Mr. Cook (Luton) went so far as to urge the flat 4d. rate without any annual charge for all heating and cooking. Mr. Long (Norwich) thought that this could be done for private houses, where the diversity factor was great, but was doubtful as to shops. With regard to the points raised as to the apparatus used, Mr. Allen did not believe that the present time was a suitable one for an attempt to standardise cookers, as development was so rapid, and might turn along totally different lines from those followed at present. Mr. Rolls (Bradford) mentioned that in his district the demand for lamp radiators had almost ceased, but the trouble with the hot-bar style has not been in selling them, but in getting them from the makers. Mr. Beauchamp (West Ham) drew attention to the advantages of combined radiators and convectors, and Mr. Seabrook (Marylebone) spoke of the economies to be effected by the adoption of thermostatic control.

The National Illumination Committee of Great Britain.—This committee, which was constituted by co-operation of the Institutions of Electrical and Gas Engineers, the National Physical Laboratory, and the Illuminating Engineering Society, consists of Messrs. E. Allen (chairman), W. Duddell, and A. P. Trotter (vice-chairmen), W. J. A. Butterfield (Secretary and Treasurer), Frank Bailey, J. Bond, H. C. Colman, K. Edgcumbe, L. Gaster, R. T. Glazebrook, F. W. Goodenough, Haydn T. Harrison, J. Kerr, J. T. Morris, C. C. Paterson, S. P. Thompson, and R. Watson. Of these Messrs. Duddell and Colman have been appointed representatives on the Executive Committee of the International Commission on Illumination. The annual report states that the work of the committee has consisted mainly in the establishment of rules and the appointment of officers. Regarding the rating of light sources the following resolution has been passed:—"It is desirable that a uniform International method be adopted for rating and marking all sources of light. It is recommended by the National Illumination Committee of Great Britain that the matter be considered at the next session of the International Commission on Illumination, and the administration of that Commission is asked to take the necessary steps to bring this resolution to the knowledge of the different National Committees with a view to their co-operation." A sub-committee has been appointed to draft sets of definitives and nomenclature.

POLYPHASE COMMUTATOR MOTORS

A PAPER on polyphase commutator motors and their applications, by Mr. N. Shuttleworth, was read last night before the Birmingham Local Section of the Institution of Electrical Engineers. After some general remarks on the effect of a rotating field on an armature with three brushes, these machines were classified into series and shunt, the former implying constant field usually associated with constant speed under load, and the latter with compound excitation with varying speed under load. The real advantage of the commutator machine over the induction motor was the possibility of speed variation without loss of efficiency. For single speed work its advantage of improved power factor was not sufficient to outweigh the increase in cost.

The Latour motor is fitted with three-phase compensating winding and a three-phase armature. Instead of using a separate shunt exciting winding, the armature winding is used for this purpose, and an exciting voltage is impressed between the brush studs from the secondary of a transformer, the primary of which is connected to the supply system. The armature winding of the motor therefore carries in addition to the load current an exciting current, which produces the working field of the motor. The windings of the transformer carry only a wattless current, which is at right angles in phase to the voltage induced from the primary. The latter fact enables a very simple means to be employed for varying the terminal voltage of the secondary of the exciting transformer, and for this purpose the star point of the secondary is completed through a variable reactance. A voltage-drop due to the magnetising current flowing through the reactance is exactly opposite in phase to the voltage induced in the secondary of the transformer; since the voltage appearing in the windings is constant under all conditions, the terminal voltage impressed on the brushes of the motor will depend upon the magnitude of the voltage-drop in the reactance, and the reactance is therefore a means of varying the impressed voltage on the field winding of the motor—this being done also without any change in phase. It will be observed that the reactance is strictly analogous to the field rheostat of a continuous-current shunt motor, the transformer is made with a movable secondary, so that the phase of the voltage obtained may be varied. A six-pole 25-B.H.P. motor of this kind can have a speed variation of 50 per cent. above and below synchronism, but for large sizes the speed range is much more limited.

Another example of a variable-speed motor with shunt characteristics is the Eichberg three-phase commutator motor, which has an armature fitted with a compensating winding, and exciting voltages are impressed from the auxiliary auto-transformer, permanently connected in star to the supply system, and provided with tappings, each of which may in turn be connected to the brushes. By varying the ratio of the two arms in each phase of the auto-transformer there is a different ratio between the armature and compensating-winding voltages on the motor, and this implies variable armature speed. This type of machine cannot be built in very large sizes owing to commutation difficulties.

The development of the series commutator motor was retarded by commutation difficulties. The stator winding is similar to that of an induction motor, and the armature is similar to that of a continuous-current motor. The extremities of the stator winding are connected to the motor terminals and to brush studs on the commutator respectively. It is now usual, however, instead of connecting the stator winding directly in series with the armature, to introduce a transformer which reduces the voltage impressed on the armature; this is necessary to improve the commutating conditions, but it incidentally isolates the armature and commutator from the supply system, and therefore allows the stator winding to be designed suitable for a high-tension system. An alternating-current series motor can exert any required torque over a considerable speed range, and this is rendered possible by the simple movement of the brushes round the commutator relative to the stator. It is not suited for constant-speed work, but may be used to drive fans, blowers, centrifugal pumps, and such machinery as calendering and calico printing.

Another important application of the polyphase commutator motor is in cascade with a variable-speed induction motor for utilising the energy otherwise lost in the rotor circuit. In the Krämer method the shaft of the commutator motor is coupled direct to the main motor. This is effective provided the speed is moderately high, and a low-speed motor requires an unnecessarily expensive commutator motor. The other method is well known, and is due to Dr. Scherbius.

The commutator motor is direct coupled to a squirrel-cage induction generator, which in turn is electrically connected to the supply system. A further development, due to M. Milch, is to employ the commutator motor as a commutator generator and to run the induction motor above synchronous speed as well as below.

The variability in the power factor of a brush-shifting series commutator motor at once precludes it from successful use in cascade with an induction motor, since the power factor if variable must be under perfect control for all frequencies as in a shunt commutator motor. A fixed brush position is therefore adopted, and the stator is fitted with a special three-phase winding placed with a certain angular space relation to the armature with fixed brushes and connected in series therewith. It becomes possible, therefore, by means of a variable shunt, to vary the excitation, and therefore the flux and voltage of the commutator machine through any desired amount for any current.

Motors of this class are employed to utilise the energy otherwise lost from induction motors controlled by slip regulators in flywheel motor-generator sets by the British Thomson-Houston Co. Another variable-speed commutator motor is that of Schrage, in which an induction motor and cascade-connected shunt commutator motor are combined as one machine.

SURFACE CONDENSERS

A PAPER by Mr. T. R. Houston on "Modern Surface Condensing Plants" was read on Tuesday last before the Rugby Engineering Society. It was well known, remarked the author, that a vacuum of 26 to 27 in. was the utmost that a reciprocating engine could utilise efficiently, as at higher vacua not only must the L.P. cylinder and its ports be of excessive size, but there was risk of considerable condensation in the cylinder. With the steam turbine, however, these limitations disappear, and the efficiency increases of the turbine itself increases rapidly with the vacuum. The economy of the whole plant, however, reaches a maximum at a vacuum depending on the cost of the condensing plant, cost of running, auxiliaries, &c. For cooling water at 60° F. the maximum economy is reached at about 28·6 in., and for cooling water at 80° F. at about 27·3 in. The most essential points in the design of a surface condenser are that the steam should be distributed as evenly as possible over the whole tube surface; the steam velocity should be as constant as possible across the condenser; the drop of pressure across the condenser should be a minimum; the form of shell should be mechanically strong; the air-pump suction should be as far as possible from the steam inlet, and so arranged that "short-circuiting" of the steam between these points is avoided; the design should avoid the possibility of any part of the condenser remaining "air-drowned"; the condenser should be as cheap as possible without unduly sacrificing the foregoing points:

The amount of tube surface necessary for the condensation of a given quantity of steam under given conditions depends on the rate of heat transmission from the steam to the water. This rate is usually expressed as B.Th.U. per hour per square foot of external tube surface per 1° F. mean temperature difference between steam and cooling water, and is then known as the "coefficient of heat transmission." The effect of small quantities of air leaking into the condenser is the most difficult point to allow for in condenser design. Its effect is that the condenser temperature will be lower, and the temperature difference between steam and cooling water therefore less, and the air will hinder the transfer of heat to the tubes by reason of its bad heat-conducting properties. In other words, the air will tend to insulate the tubes.

Air pumps were classified under the following heads:—Reciprocating dry air pumps, reciprocating wet air pumps, steam jet ejectors, rotary air pumps, and water jet ejectors. The last-mentioned is not so well known as the others. A successful example is the Müller air ejector of Willans & Robinson. Water is pumped under pressure through a nozzle, in which is fitted a special cone provided with helical vanes to break up the stream of water and impart to it a swirling motion. The design of this cone plays an important part in the working of the ejector. The water jet issuing from the nozzle entrains the air from the condenser and the aerated jet is ejected into the taper pipe or diffuser, where the air is gradually raised to atmospheric pressure as the velocity energy of the water is given up. The air passes to the nozzle chamber through the non-return valve, which is connected to the air branch on the condenser. In connection with this valve is a vacuum-breaking valve. The

water pressure falls below a pre-determined amount, and there is a possibility of water being drawn into the condenser; this valve will open and admit a rush of air into the ejector and force the flap valve on to its seat. The ejector may be coupled up with a circulating pump of sufficient size to deal with both the circulating and ejector water, or the circulating water may be passed through the ejector and condenser in series. A third arrangement is to provide a separate pump for the ejector.

LIGHTNING AND SURGE ARRESTERS

A PAPER on protective devices against lightning and surges, by Mr. E. Kilburn Scott and Mr. L. F. Fogarty, was read last Friday before a thinly-attended meeting of the London Branch of the Association of Mining Electrical Engineers. The Paper treated the subject generally, not relating in particular to mining installations. After some introductory remarks, several forms of spark-gap arresters were described, including the comb, mica washer, blow-out, and Wurtz or roller types, and various patterns of the horn arrester, mentioning the relay type with an extra pilot gap below that of the main horns. An electromagnetic blow-out was sometimes used to hasten the action. Another device was the provision of movable strips which were attracted towards one another when an excess voltage was reached, and fell away as soon as the spark passed. The aluminium electrolytic arrester was also described briefly. One objection to its use was its liability to reduction in its protective power due to frost. It was, however, largely in use in the United States. For pressures above 5,000 volts, water-jet arresters were used to a certain extent. Passing on to resistance for use in series with spark-gap circuits to limit the energy following the discharge, the authors described the carbondum, carbon dust, liquid, and wire types. Another important part of the equipment was the choke coils to prevent the passage of the discharge to the working circuit. In the Burke arresters this is made to form one of the horns, and in the Gola arrester a choking coil with an iron core is used to reflect the surge, and the extra time thus occupied helps the horns to discharge. Some notes on the establishment of earth connections were also given.

A somewhat different principle was used in the Giles electric valve. A first spark-gap was placed in series with a resistance, and a number of further gaps each indirectly connected to earth by a small condenser, while the last electrode is directly connected to earth. The action of these condensers causes an even distribution of the voltage over the smaller gaps when the main gap has once sparked over. Several of these appliances are used in parallel. It is found that the terminal pressure at the valve sinks very little below that for which the main gap is adjusted, and the sparks cease spontaneously without having recourse to any blow-out arrangement. The valve does not act during the whole period, but only during that time in which the surge tension occurs, and its effect is to cut off from the voltage curve all the peaks which are beyond the value for which the gap is regulated. This is quite different from the horn arrester with its persistent arc, through which a much larger amount of energy passes.

The latter part of the Paper discussed generally some of the various causes of surges, and drew attention to the possibility of serious effects being produced on the end windings of machines, &c., by surges of which the maximum voltage was insufficient to put the arrester into action. It was explained how such voltages could be concentrated over a few turns of an armature winding and puncture the insulation unless specially protected by choking coils. Sometimes the very action of a horn arrester set up the very surges which it was its function to protect against. A system of protection in use to a considerable extent on the Continent was by the application of condensers, particularly those of the Moscicki type. The most usual method of installing these condensers is to insert between the overhead conductors and the machines or plant to be protected a choking coil, and to connect the condenser between the choking coil and earth in such a way that any high-frequency oscillations tending to propagate themselves into the station would be reflected back on to the line and earthed through the condenser. Such condensers are also of considerable use as a protection against surges due to switching, when their method of affording protection can be compared to the relief which would be afforded in an hydraulic system by an air chamber. It is a well-known principle in hydraulics to provide an air chamber for the purpose of preventing phenomena known as water-hammer, where advantage is taken of the cushioning

effect due to the elasticity of air. In a similar way an electrical condenser properly installed provides a means of flattening out the peaks of a transient voltage curve, and in this way affords relief to the system.

POSSIBLE INCREASE IN THE CHARGES FOR ELECTRICITY

THE electricity supply stations in London have escaped the necessity of curtailing supply on account of lack of coal, although one was reduced a week ago to a stock sufficient for only one day's requirements and another to three days', yet the enormous increase in the price is becoming more and more serious. Electricity works, which until a few weeks ago were paying 12s. 6d. per ton for coal suitable to their requirements, are now being asked prices up to 23s. for the same quality, and although this enormous increase is not general, yet prices are steadily advancing, and the shortage of supply is so serious that the works are compelled to buy, and coal merchants have matters their own way. The increased insurance and the longer time required for transit must necessarily raise the cost of sea-borne coal, but it is difficult to see why rail-borne coal should be affected except by the law of supply and demand. The shortage of trucks, owing to the congestion on the railways, is no doubt serious, but neither the actual cost of raising the coal nor its conveyance to London should be greatly increased, and it is obvious that there is a danger of undue profits being taken. We are loth to suggest that the hard-worked Government departments should be worried, but the time has certainly come when pressure might reasonably be brought to bear on them to impose a limit on the price of coal and its transport.

If prices continue to rise, the electricity supply authorities will have no option but to increase the price charged for electricity, and we have reason to believe that some have already in contemplation the necessity of doing this. Cases of a general increase in rates have been rare, and there is very little precedent to go upon, but so long as the price does not exceed the maximum laid down in the supply undertaker's Electric Lighting Order or Special Act, there is nothing to invalidate an immediate increase in rates except when there is a contract with the consumer to supply at definite charges per unit without a "coal clause." It would be very regrettable if this step should have to be taken, but it must not be forgotten that, in addition to the increased generating costs owing to the rise in the price of coal, the supply companies have also to face a decrease in the consumption of electricity due to diminished shop lighting and street lighting, and general economies on the part of the public, so that the establishment charges per unit must necessarily increase. They have also to reckon with the fact that they are contributing to the support of the dependents of the large numbers of their staff on military service, and at the same time have to engage other men to do the work of those who are away. The situation is, in fact, difficult enough without an artificial rise in the cost of rail-borne coal.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Magnetism and Electricity," by S. S. Richardson. 598 pp. 7½ in. by 5 in. 260 figures. (London: Blackie & Son, Ltd.) New edition. 4s. 6d.; abroad, 5s.

"Electrical Engineering in India," by J. W. Meares. 517 pp. 8¾ in. by 5¾ in. 74 figures. (Calcutta: Thacker, Spink & Co.; London: W. Thacker & Co.) 15s. net.; abroad. 15s. 9d.

REVIEWS OF BOOKS

Polyphase Currents. By A. Still. 800 pp. 7½ in. by 5 in. 101 figures. (London: Whittaker & Co.) Second edition. 6s. net; abroad, 6s. 6d.

This is a second and revised edition of a book which is too well known to need a special introduction to our readers. The author addresses neither the beginner nor the specialist, but aims at giving the student, already familiar with continuous-current phenomena, a general idea of the principles and applications of alternating and polyphase currents. The

treatment does not call for much knowledge of mathematics, and a special feature of the work is the extensive use of graphical methods, including "clock" and vector diagrams, &c. Neither machine nor switchgear design fall within the range of the book, although there is a great deal of really practical engineering information regarding alternators, transformers, induction and other A.C. motors, rotary converters, &c.

The Electron Theory of Matter. By O. W. Richardson. 612 pp. 8*½* in. by 5*½* in. 58 figures. (Cambridge: The University Press.) 18s. net; abroad, 18s. 9d.

The bearing of the electron theory on a wide range of physical phenomena is reviewed in this work, which is directed towards showing how the fundamental facts on which they depend may be co-ordinated by the modern conceptions of the electron and the latest aspect of electro-dynamics. The author has based his work on lectures given by him at Princeton University, which were intended as an introduction to the more advanced methods of mathematical physics, in addition to presenting some of the results of recent physical discovery. Although the treatment is necessarily somewhat mathematical, the mathematics do not form the chief feature of the book, the great value of which is in how the various facts elucidated by recent research fall in with the general scheme of the electron theory, and how some of our pre-conceived ideas must be modified to realise the consistency obtainable from the new point of view.

The Practical Electrician's Pocket Book for 1915. Edited by H. T. Crewe. 474 pp. 5*½* in. by 3*½* in. 272 figures. (London: S. Rentell & Co., Ltd.) Cloth, 1s. net; by post, 1s. 3d. Rexine, 1s. 6d. net; by post, 1s. 9d.

The contents of this well-known pocket book have been rearranged somewhat in preparing this year's edition. With a view to obtaining improved logical sequence of the subject matter some of the older matter has been omitted or condensed, and entirely new sections appear on the important subjects of Electricity in Coal Mines and Distributing Systems, and on a well-known system of electric clocks. Many other sections have been brought up to date, and the useful feature of a central station directory is retained.

The "Mechanical World" Pocket Diary and Year Book for 1915. 439 pp. 6*½* in. by 4 in. 81 figures. (Manchester: Emmott and Co., Ltd.) 6d. net; by post, 8d.

The 1915 edition has been revised and brought up to date with all the care characterising the many previous editions of this wonderful sixpennyworth. New matter appears on gearing and gear-cutting, structural iron and steel work, and other branches of the subject, and the gas-engine section has been extended. Electrical matters are reserved for the companion volume, the "Mechanical World" Electrical Pocket Book.

"Mechanical World" Electrical Pocket Book for 1915. 6*½* in. by 4*½* in. 130 figures. (Manchester: Emmott & Co., Ltd.) 6d. net; by post, 8d.

This wonderfully complete sixpennyworth grows in size from year to year. In this edition a new section appears on electric circuits and switching, and new matter has been introduced on synchronising and phasing out. The portion dealing with the diagnosis and remedy of defects in generators and motors has been rewritten and additions have been made in the excellent sections on electricity on board ship and in collieries. These and other improvements show how thoroughly the work is kept up to date.

Hazell's Annual for 1915. Edited by T. A. Ingram. 592 pp. 7*½* in. by 5 in. (London: Hazell, Watson & Viney, Ltd.) 3s. 6d. net; abroad, 4s. 2d.

The 1915 edition of this Annual contains a number of special features, among which may be mentioned an interesting account of the meetings of the British Association in Australia last autumn. The war prevented the publication of the usual full accounts in the newspapers here, and it is felt that this special account will to some extent repair the omission. Considerable space, naturally, is devoted to the war, but the usual sections are nevertheless increased in size in many instances. The list of societies now include the American societies.

I.E.E. Associate Membership Examination.—An examination will be held on Friday and Saturday, April 30th and May 1st, at the Examination Hall of the Royal Colleges of Physicians and Surgeons, Queen Square, Bloomsbury, W.C. Should a sufficient number of candidates make application, arrangements will be made for the examination to be held concurrently in local centres. Entry forms, which must be returned not later than March 1st, may be obtained, together with the Examination Regulations, on application to the Secretary of the Institution.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,429.

When the triple-pole switch of a 20-h.p., 3-phase, 40-cycle, 550-volt motor is put in, the motor frame is "alive" (flashing it to earth gives a very visible spark), but when the rotor starter is moved to the first step, and the motor starts up, the frame ceases to be "alive," and remains "dead" as long as the machine continues to run. When the stator windings are tested with a "megger" the insulation resistance to earth is 15 megohms. What is the cause of this? "ERTH."

(Answers must be received not later than first post Thursday, Feb. 18th.)

ANSWERS TO No. 1,427.

A shunt-wound commutating pole generator, driven by an induction motor, shirks the load when run in parallel with other identical machines, yet deals satisfactorily with the load when run alone. What is the probable cause of this?—SPARK GAP.

The first award (10s.) is given to "M. M.," who writes as follows:—

For direct-current generators to run satisfactorily in parallel, they should have similar characteristics, such characteristics showing a slight falling off in voltage with increased load. Prime movers should give constant speed, though it is not essential that each generator should run at the same speed. Even with otherwise suitable conditions the trouble can easily be accounted for if brushes are in wrong positions. The brushes of the machine shirking its fair share of the load may be in such a position as to give a more drooping characteristic than the others. Give the generator taking the small load a backward lead to its brushes, and increase the lead of brushes on the other machines. Coupled with good shunt regulators, this may meet the difficulty. Although the induction motors driving the generators may be of a similar type, it must not be taken for granted that the "slip" of each increases proportionately with increased load. A slight difference in magnetic leakage or resistance of windings may give a sufficiently drooping speed curve to account for the one machine not taking its share of load when running with others. By itself the difference may be so slight as to escape notice. A speedometer will soon give evidence on this point.

To come back to quite simple matters, the fault may be due to faulty fittings or connections. Suppose, for instance, there are bad contacts at the main switch; "drop" across these contacts will readily account for a machine shirking its share of the load. Quite a small difference in voltage will cause a serious out of balance. The remedy for such a state of affairs is obvious. Generally:—(1) Find out if speed curves of induction motors are similar; this may mean a troublesome matter, and need attention by the makers. (2) See that brushes are in good order and that all switch contacts, &c., are satisfactory; this should give little or no difficulty. (3) Plot a characteristic from each

generator; should these differ, much may be done by altering brush positions and shunt regulation.

The second award (5s.) is made to "E. P. H.," who writes as follows:—

The trouble experienced can be the result of either (1) defects in the motor, or (2) defects in the generator, resulting in poor parallel running.

(1) *Motor Defects.*—(a) The air-gap in the case of this set may be larger than in the case of the others, and, in consequence of the heavier magnetising current, extra heating and drop of speed and consequent load follow. (b) If a slip-ring type of motor, the joints to rotor cables, internal and external, should be examined, and also rotor tested for bad joints, as these are a frequent source of drop of speed.

(2) *Generator Defects* (most probable source of trouble).—(a) Incorrect adjustment of brush positions between machines. (b) The machine in question having commutating poles, although it is nominally a shunt machine, it is quite possible for a compounding effect to be produced by the commodes. The machine may have larger air-gap under its commodes than the others, and in consequence not stand up to load in the same degree. Frequently this can be counteracted by rocking the other machine brushes forward and this one backwards slightly from neutral zone. (c) The brush drops may be larger on this machine, due to rough commutator, high mica, oil on commutator, or defect in armature or balance connections. Eccentricity in field also will produce this, with the consequential drop of load in comparison with good machines. It is quite possible, however, that merely adjustment of brush positions or slight shunting of commodes of other machines will enable perfect parallel running to be obtained.

HEATING OF FIELD COILS

A PAPER by Prof. Magnus Maclean, Mr. D. J. MacKellar, and Mr. R. S. Begg, read on Feb. 9th before the Scottish Local Section of the Institution of Electrical Engineers at Glasgow, described a research into the distribution of temperature rise in field coils. One of the field coils of a motor had a series of thermo-junctions inserted at various depths, and curves were plotted of the rise of temperature at each point in various circumstances. A number of these curves are given in the Paper. It was noted that the ratio of the final rise of temperature to the number of watts is greater for the higher speeds. The following formula is given by Hawkins and Wallis for the rise of temperature of field coils:—

$$\frac{\text{watts}}{\text{area}} \times \frac{a}{1+bv}$$

where a and b are constants, and v =peripheral speed in metres per second. Experiments at a light load give mean values of $a=198.6$ and $b=-0.0263$, and at heavy load $a=232.8$ and $b=0.023$ for these constants.

The L.C.C. Power Scheme.—It is stated that the Parliamentary Agents for the London County Council's Electric Power Bill, which was, as reported in our last issue, rejected at the meeting of the Council on Feb. 2nd, have received instructions not to withdraw the Bill. There is apparently some intention of endeavouring to arrange a special meeting at which the vote on the Bill on the 2nd inst., which was given under somewhat peculiar circumstances, may be reconsidered. Meanwhile, the Parliamentary Committee report that, in addition to Messrs. Merz and McLellan being retained as experts in connection with the Bill, Mr. Robert Hammond has also been retained to conduct negotiations with certain of the authorised distributors concerned in that Bill. This report, however, relates to action taken by the Committee to the end of December, 1914, and is not subsequent to the vote on the 2nd inst.

The Enemy's Trade.—The Advisory Committee of the Board of Trade on Commercial Intelligence continues to receive inquiries for the names of sellers or buyers of articles formerly obtained from German or Austro-Hungarian sources. Special arrangements have been made for dealing with these inquiries, and lists are prepared and circulated of articles which inquirers desire to purchase and to sell. The eighth of these lists is now ready. British firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

ELECTRIC TRACTION NOTES

The Board of Trade Report of Col. von Donop into the accident at Barnsley on Dec. 2nd, when a tramcar ran away down a hill, knocked down the wall of a house, and severely injured six passengers, two of whom died. It appears that the car was standing at a terminus on a down grade held only by the rear hand-brake, and the driver had got off and was talking to another driver. The conductor, not noticing that the driver was absent, released his brake and gave the signal to start. He did not notice that anything was wrong until considerable speed had been attained, when he lost his head, failed to make his brake hold, and jumped from the car, leaving the passengers to their fate.

Another runaway tramcar accident, at Devonport, on Nov. 27th, is dealt with in a report by Col. E. Druitt. In this case an overcrowded workmen's car approached a steep down grade at a rather high speed, and the driver was unable to check it in time owing to having skidded his wheels. The car therefore reached a curve at the foot of the hill at a speed sufficient to make it turn over. The Inspector considers that had the car not been so overcrowded, it would probably not have overturned.

A Committee has been appointed, under the chairmanship of Mr. H. F. Parshall, to devise a scheme for payment of interest on the bonds of the Barcelona Traction, Light & Power Co., which is in default. Holders of bonds are recommended to communicate with Mr. Parshall at Salisbury House, London Wall, E.C.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A few further particulars are now available with regard to the New York-San Francisco telephone line, mentioned in our last issue. There are two "physical" circuits, each of 0.165 in. diameter hard-drawn copper wire, and a small length of cable line (less than 10 miles) is included. A phantom circuit is worked. The length of the actual line between the two cities is 3,400 miles, involving the use of 5,920,000 lbs. of wire and 130,000 poles, and £400,000 worth of line material is practically given up to the exclusive use of the three pairs of people who are speaking on the lines at any moment. On some sections, however, superposed telegraph circuits are also in use.

We are informed that the German Patent (No. 210,151) corresponding to British Patent No. 5,547/07 of Siemens Brothers and W. Dieselhorst, for armouring submarine telephone cables containing loading coils by applying in the closing machine a second sheathing over the first in such a manner that the two combine and form a single sheathing over the expanded part containing a coil, has been before the German Patent Court at the instance of a well-known firm of submarine cable manufacturers, who demanded its revocation on the ground of anticipations; but the decision was that these were not substantiated, and the patent was upheld in all its claims.

A good deal of progress has been made with the construction of the high-power Marconi stations for direct communication between Norway and the United States. The American stations, of which some details are given in the *Wireless World*, are the most advanced. The receiving station is at Chatham, Cape Cod, Massachusetts, and the transmitting station at Marion, forty miles distant. The directional aerials are about $1\frac{1}{2}$ miles in length, and a balancing aerial at Chatham screens this station from interference from Marion, so that duplex working can be adopted. The main aerials are supported on 14 steel tube masts each 423 ft. high. Power will be taken from public service mains. The Norwegian receiving station will be on the Udlanheng Hill overlooking the Stavungen firth, and the transmitting station at Nærbo, 26 miles distant, will derive power from a local water power system. The equipment will be similar to that of the American station.

An interesting account of the researches which Prof. E. W. Merchant has been conducting into the conditions affecting the variations in the strength of wireless signals was included in a Paper read by him on Tuesday at a meeting of the Manchester Local Section of the Institution of Electrical

Engineers held at Liverpool University. Most of the measurements made were between Liverpool and Paris, which lie mutually almost north-west and south-east; a few results are also recorded in connection with the Goldschmidt station near Brussels, which was destroyed. A crystal detector was used at Liverpool, and the current received by the antenna was estimated from the current flowing in the crystal circuit after the various constants of the circuit had been determined. Both a Broca and a Einthoven galvanometer were used to produce the records. The observations are discussed in some detail in the Paper, and the results are summarised as follows:—That between two stations lying nearly north-west and south-east of each other the strength of signals during the daytime varies within comparatively narrow limits. That the ratio between the night and day strength varies with the time of the year, and also from day to day in any given month. That on a fine clear day the "sunset effect" occurs about three-quarters of an hour after the actual time of sunset, and varies with the weather conditions. When rainy

conditions prevail, the strengthening of the signal after sunset is much less marked. That the amount of the sunset effect varies with the direction in which signals are emitted. That there is very little evidence that between two stations, such as Liverpool and Paris, where the difference in longitude is about 22 minutes, there is anything in the nature of a dense fog which is opaque to waves, and which causes a drop in signal strength when the dark-light band lies between the two stations. The variations during the night are relatively great, and occur within the space of a few minutes. The greatest increases in strength of signals have been observed after the cessation of rain either at the sending or receiving station. That the character and extent of the variations in signal strength point to the conclusion that the main factor which controls the variations is the state of ionisation of the atmosphere, and that it seems likely that clouds of ionised air may exist in the upper regions of the atmosphere which act as mirrors for the waves and cause the sudden changes in signal strength that have been observed.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 4th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

28,838/13. Telephone Repeater. W. H. DERRIMAN (*Automatic Enunciator Co.*). A telephone repeater, comprising an electromagnet and a differential or other microphone with a direct rigid connection between the armature of the electromagnet and the movable electrode of the microphone. Various adjustments are provided, and a special vibration insulating material separates the electromagnet from the supporting structure of the microphone. (Six figures.)

590/14. Resistances. G. MASCARINI and A. CONTARDI. Resistance containing sulphide of iron or similar materials have a high negative temperature coefficient, and according to this invention are applied to the rotor resistances of induction motors giving automatically the required decrease of resistance as they warm up. The resistance can be made very compact and be embodied in the rotor, so that only an internal short-circuiting switch but no slip-rings are required. (Three figures.)

1,341/14. Combined Starting Motor and Lighting Dynamo. A. H. MIDGELEY and C. A. VANDERVELL. This machine has separate commutators and armature windings for use in its two functions and the field windings, which as a self-regulating dynamo leave half the poles unexcited, are regrouped to give the full number of poles when working as a motor. (Two figures.)

5,456/14. Metal Filament Lamps. B.T.-H. Co. (*G.E. Co., U.S.A.*). Gas-filled metal filament lamps with short filaments, such as automobile lamps, with the filament of thinner section at the point where the cooling effect is greatest, i.e., near the supports. (Four figures.)

7,145/14. Heaters. O. C. HAWKES. Heating elements for "fires" composed of wire wound on fireclay bases with an outer fireclay or steatite fretted tube or cover close enough to the wire for the whole to be brought to a luminous glow. (Five figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BERRY [Supply system] 26,495/13; ROWLEY and SANRAINÉ SYNDICATE, LTD. [Insulating material] 1,133/14.

DYNAMOS, MOTORS AND TRANSFORMERS: GRAEMIGER [Motors for driving enclosed machines] 8,700/14.

Electrometallurgy and Electrochemistry: DIXON [Electric furnaces] 4,742/14.

Heating and Cooking: WEAVING and FERRANTI, LTD. [Liquid heaters] 28,932/13.

Ignition: MACNAB [Ignition and starting system] 29,216/13; MASON [Magnetics] 21,774/14; WADE (*Mason*). [Magnetics] 23,142/14.

Storage Batteries: GIFFINS and WATSON [Charging and discharging] 2,174/14.

Switchgear, Fuses and Fittings: COLLIE [Switches] 2,242/14.

Telephony and Telegraphy: WESTERN ELECTRIC CO. (*Wood-*

ward for W.E. Co., U.S.A.) [Telephone desk sets] 2,215/14; BELULANDER [Automatic telephone] 18,154/14; WOODLAND [Wireless Telegraphy] 18,711/14.

Traction: VANDERVELL and MIDGELEY [Car lighting] 27,615/13; DOYLE [Electromagnetic train stop] 10,742/14.

Miscellaneous: LUCAS and EDWARDS [Electric horns] 2,380/14; DARRAS [Condensers] 14,834/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

SIEMENS SCHUCKERTWERKE GES. [Safety devices or vacuum relays for electric circuits] 722/15.

Amendment Made

16,380/14. Wireless Telegraphy. R. GALLETTI. Leave has been granted to amend this specification by the addition of the name of Galletti's Wireless Telegraph and Telephone Co., as one of the applicants. (This specification has not yet been published.)

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

3,047/01. Boosters. J. S. HIGHFIELD. A hand-regulated reversible battery booster for maintaining constant output of the generating plant with two field windings, one regulated by a reversing rheostat with a single handle, and the other connected in shunt with the main current, and regulated by resistance controlled as required by a single handle.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: S. C. MOUNT and BECK FLAME LAMP, LTD. [Flame arc lamps] 22,454/08.

DYNAMOS, MOTORS AND TRANSFORMERS: E. A. CAROLAN (*G.E. Co., U.S.A.*) [Rotors for turbo-alternators] 22,909/03; MORGAN CRUCIBLE CO. and C. W. SPIERS [Graphite and metal composition brushes] 22,659/04; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Windings for two-speed induction motor] 22,821/04, [Motor control] 21,290/05 and [Rotary converter field windings] 24,126/09; SIEMENS BROTHERS & CO., LTD. (*Siemens-Schuckert*) [Frequency changers] 24,269/09.

Electrochemistry and Electrometallurgy: M. BAUM [Deposition of platinum] 22,455/08.

Heating and Cooking: G. G. BELL [Electric oven] 23,819/09.

Ignition: VEREINIGTE MASCHINENFABRIK AUGSBURG & MASCHINENBAU GES. NÜRNBERG A.G. [Gas engine ignition] 7,733/04.

Incandescent Lamps: C. O. BASTIAN and G. CALVERT [Sealing in wires] 21,383/05.

Instruments and Meters: H. S. HATFIELD [Electrolytic meters] 22,920/06.

Switchgear, Fuses and Fittings: W. P. THOMPSON (*Schwaige & Co.*) [Time switches] 23,427/06.

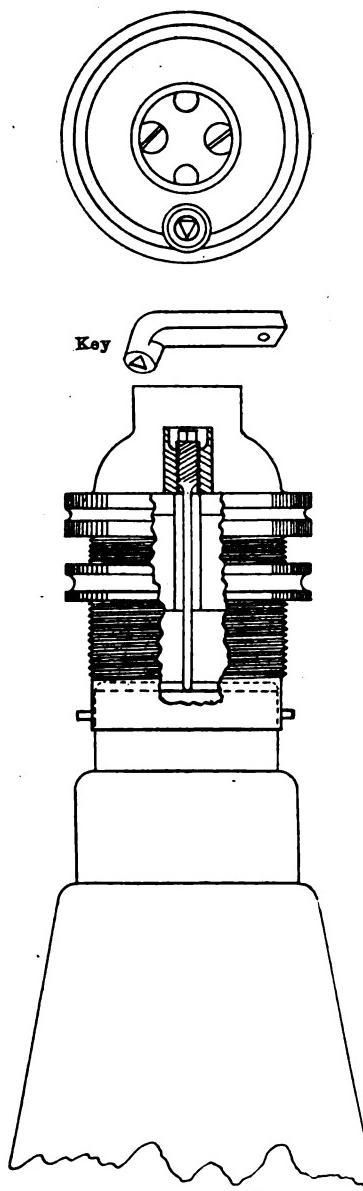
Telephony and Telegraphy: I. B. BIRNBAUM (*Tel. Fabrik A.G. vorm. J. Berliner*) [Private branch exchange working] 23,309/06.

TRACTION: F. W. LE TALL (*G. Westinghouse*) [Electro-pneumatic controller] 22,829/02; SIEMENS & HALSKE A.G. [Points and signalling] 23,533/09.

Miscellaneous: H. MANDERS [Arc high frequency apparatus] 24,134/09.

"ELECTRICAL ENGINEERING" TRADE SECTION

A LOCKING LAMPHOLDER



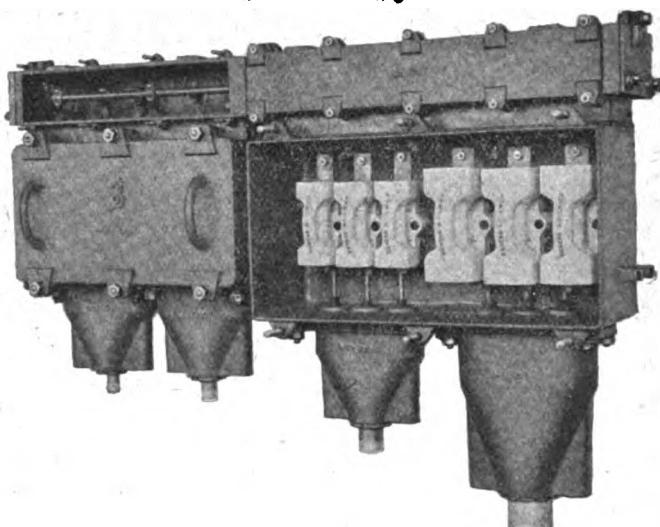
PLAN AND SECTIONAL ELEVATION
OF LOCKING LAMPHOLDER.

by using a light stamped collar resting on the shoulder of the lamp to carry the shade, and locking it by screwing down the shade-ring on the top of the shade (see ELECTRICAL ENGINEERING, Oct. 26th, 1911, p. 585). Another is an ingenious locking trigger applicable to all-porcelain battenholders of a particular type. Many of our readers know from sad experience how necessary it is to lock lamps in installations of a certain class, and will appreciate a simple means of doing so. The device is provisionally protected under the patent application of Messrs. C. M. Bennett and C. H. Jeffcoat, and all inquiries should be sent to the latter at 18 Ranelagh Gardens, Hammersmith, W.

IRONCLAD DISTRIBUTION BOARDS

We give here an illustration of a special design of ironclad distribution board which Siemens Brothers & Co., Ltd. (Woolwich), have recently put on the market for power distribution purposes in large works, where it is becoming general practice to use ordinary multicore lead-covered paper-insulated cables for motor and other circuits. These boards are designed with detachable trifurcating boxes, which can

be fitted either above or below the board. Each main fuse-box is arranged for two three-phase circuits, and forms with its bus-bar chamber and dividing boxes a complete unit. The bus-bar chamber ends are covered with plates, the special feature of this arrangement being that additional sections



IRONCLAD DISTRIBUTION BOARDS FOR 3-CORE CABLES.

can be added to either end, and extensions made at any time. The bus-bars are of copper tube, and are also easily extended. The fuses are of the Home Office porcelain shrouded type, and liberally designed for contact area. Details of these fuses are shown in the firm's catalogue No. 521, which will be sent on application.

A MISTAKE-PROOF STAR-DELTA STARTER

An improved pattern of mistake-proof star delta starter has been introduced by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.). It consists of a central drum carrying sectors and

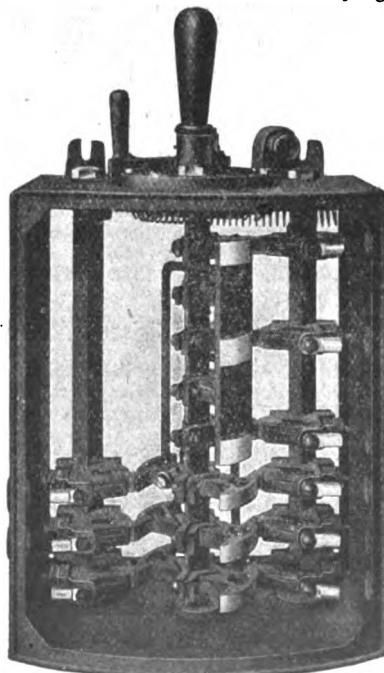


FIG. 1.—STAR-DELTA STARTER WITH COVER REMOVED.

rotating between two fixed sets of contacts. A mistake-proof device is provided, which prevents the handle being thrown right over into the running position, and so causing damage to the motor. Nothing but mica insulation is used throughout, and the stationary contacts are of the G.E.C. special self-

aligning adjustable solid copper block type (registered design No. 628,113). Every part is thoroughly accessible, and the cable connections in a simple manner, without bunching together of the cables. Each enters through a bush directly

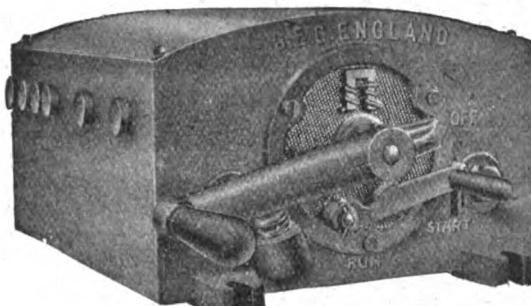
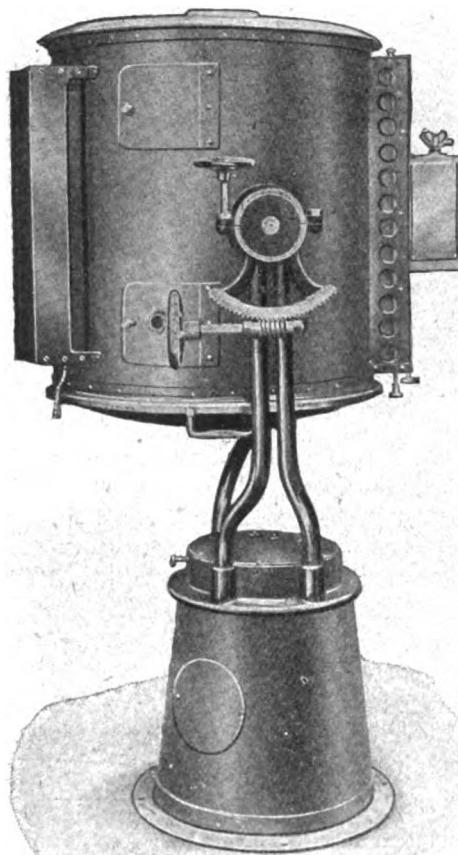


FIG. 2.—TOP SHOWING CATCH WHICH PREVENTS SWITCHING STRAIGHT INTO THE RUNNING POSITION.

opposite its sweating thimble, the cables from the motor entering on one side of the starter, and from the line on the other side. The design illustrated is suitable for 40 h.p. at 500 volts. Inasmuch as the starter completely isolates the motor in the off position, no other switch is necessary.

SEARCHLIGHTS

WE illustrate here a new pattern of searchlight projector which has been added to the numerous types that are being manufactured by the London Electric Firm (George Street, Croydon). This is a 24-inch projector, with silvered parabolic mirror mounted to give the utmost possible angular



SEARCHLIGHT PROJECTOR TILTED TO GIVE A VERTICAL BEAM.

movement, and revolving on ball bearings. A conveniently arranged quadrant and brake is provided for elevation. A new pattern of lamp is used with combined automatic and hand feed, arranged so that the carbons can be adjusted by hand while still working automatically without any change whatever. The lamp will work through a resistance on any voltage from 80 upwards

THE MOST VALUABLE WORK FOR ELECTRICIANS

By RANKIN KENNEDY, C.E.

The coupon below entitles any reader of ELECTRICAL ENGINEERING to a complimentary copy of a booklet describing what is probably the most valuable work for electricians ever published. The necessity for electrical engineers being well acquainted with all designs for installations that have given good results will be readily acknowledged by those whom the matter concerns.

While there are numerous text-books dealing with one branch or another of electrical engineering, they are all prepared for the student, and their contents deal rather with theory than with practice.

The aim of the new Edition of "ELECTRICAL INSTALLATIONS" which has just been published is to assist the practical man who is concerned with electrical installations in any form, and this because it is recognised that there exists a very large class engaged in constructive and installation work, and a still larger class whose duty it is to take care of the machinery employed in working by electricity. Most of these men have picked up a working knowledge of their employment. What they need is to study the elements of the science of the subject. These elements are fully dealt with, and on the sound foundation thus laid, the author, who is a civil and electrical engineer by profession, and recognised as being in the front rank of electricians and engineers, proceeds to deal with every possible form of electrical installation, their principles and practical application.

ALL BRANCHES DEALT WITH.

The work includes in its comprehensive scope a review of electrical instruments, with references to indicators and recorders, and alternating wattmeters, electric pyrometers, and an electric spark recorder—all of supreme importance to electricians and electrical engineers. The heavy branch of electrical engineering, dynamos, motors, alternators, transformers, are, needless to say, given in great detail and with profuse illustrations. A section is devoted to the electric ignition and electric illumination on motor-cars. Herein will be found up-to-date information on magnetos for ignition and "constant current at variable speed," and dynamo electric generators.

Dual ignition systems are fully dealt with, so, too, are "electrical installation accessories," wiring switches, switchboards, regulators, electrical signals, telegraphs, telephones, and wireless telegraphy.

Electrical appliances in workshops, factories and steamships are now more numerous, and are daily becoming more commonly in use in every department of commercial industry; hence it is more and more necessary that mechanics, fitters, plumbers, engineers-in-charge, marine engineers and others should have an intelligent knowledge of the subjects given in this work—a knowledge which, added to his trade training, makes a man valuable far beyond the mere tradesman.

A FREE BOOKLET

To the CAXTON PUBLISHING CO., LTD.,

97, Surrey Street, London, W.C.

Please send me, free of charge, and without any obligation on my part, Illustrated Booklet on the Book of ELECTRICAL INSTALLATIONS and particulars of your plan whereby the volumes are delivered for a first payment of 1s. 6d., the balance being paid in small monthly instalments.

NAME

Send this Form on a Post Card.

ADDRESS

BEUTELL LIGHTING

IN our last issue we referred briefly to the catalogue of fittings for concealed lighting, shop-window lighting, &c., which have been brought out by Messrs. A. W. Beutell, Ltd. (Army and Navy Mansions, Victoria Street, S.W.). We have now had an opportunity of inspecting these, and have been much interested in the practical design and the large number of useful applications for these fittings. It was to Mr. A. W. Beutell that the invention of "linolite" was due, many years ago, and it is the tubular lamp in its latest and improved form, with metal filament, that is employed in the majority of the fittings in question. Reflection and

30 and 60 watt 200- to 250-volt lamps of the same overall dimensions ($1\frac{1}{8}$ in. diameter) are also supplied. The holders for the lamps are of porcelain, mounted on the reflector, with spring plunger contacts, and by an ingenious design of the terminal block the wire is simply clamped in without any screws.

Fig. 1 shows one of the most useful forms of reflector. It will be noticed that it is corrugated at an angle of 45° with the lamp tube, and the depth and arrangement of the corrugations has been carefully calculated so that streaks, representing multiple images of the lamp filament, are entirely absent. In this case the reflector is of silvered glass, and is carried by a wood moulding; it is suitable for shop-

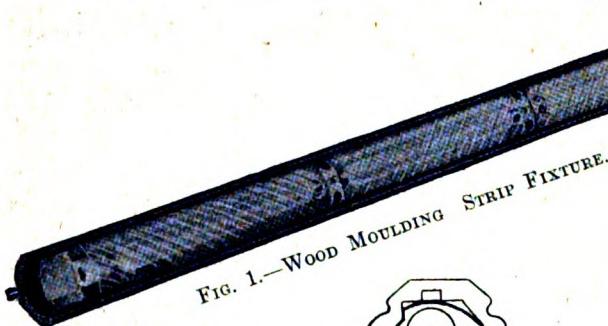


FIG. 1.—WOOD MOULDING STRIP FIXTURE.

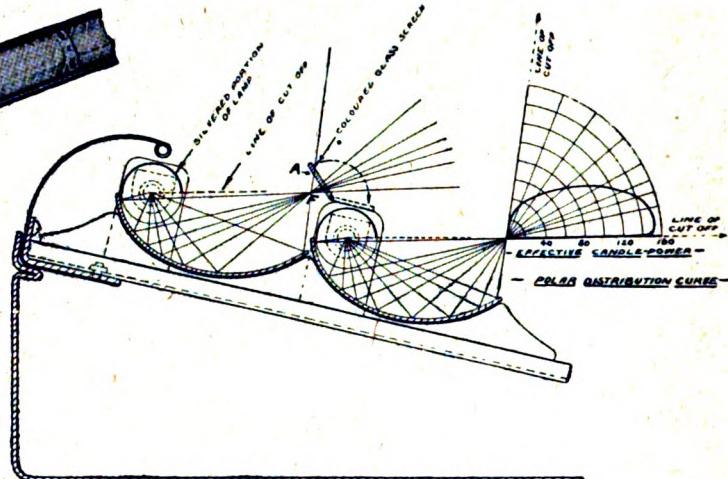


FIG. 3.—DIAGRAM OF FOOTLIGHT ARRANGEMENT.



FIG. 5.—NEW DINING-ROOM FITTING.

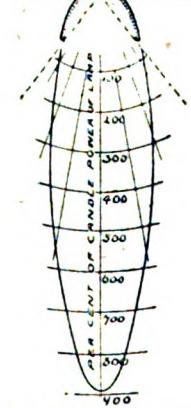


FIG. 2.—POLAR CURVE OF FIG. 1.

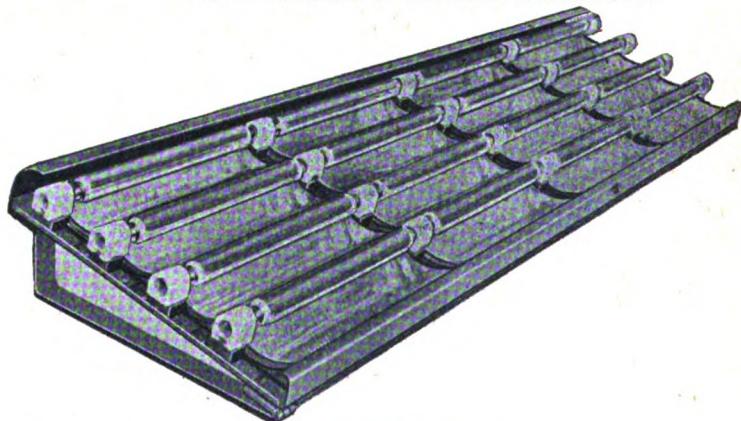


FIG. 4.—FOOTLIGHTS.

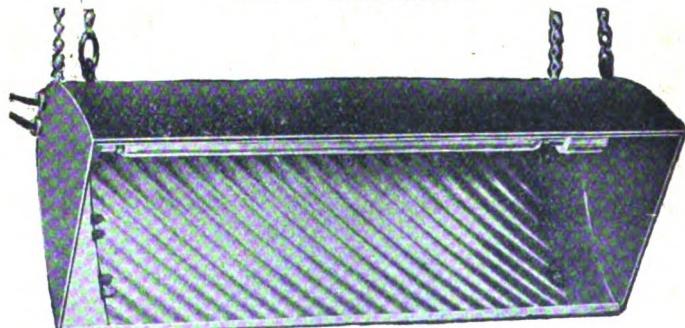


FIG. 7.—OUTSIDE SHOP WINDOW FIXTURE.

focussing of the light of an ordinary lamp is not possible with absolute accuracy owing to the large amount of space occupied by the filament and its irregular shape, but when the source of light is practically a straight line, as in the tubular lamp, the conditions are very different. It has thus been possible to construct a range of reflectors for various purposes to give the light exactly in the direction required, and with the maximum efficiency of illumination.

A standard length of lamp, 12 in. between centres, is employed. The 50-volt lamps (in wattages from 10 to 60) have a practically straight filament, and are used in series, when the length of the reflector can be somewhat over 2 ft. on a 100-volt circuit or 4 ft. on a 200-volt circuit, but the same wattages are available in 100- to 130-volt lamps; and

windows and concealed lighting generally. The polar curve of illumination is seen in Fig. 2, which shows that $5\frac{1}{2}$ times the rated candle-power of the lamp is sent in the direction required. Fig. 7 is a reflector designed for illuminating shallow or high shop-windows from outside; and Fig. 6 gives the light distribution which is actually equivalent to nine times the rated candle-power of the lamp in the direction desired. There are many other patterns. It may be mentioned that, with these improvements, it is claimed that good shop-window illumination can be obtained with only one 60-watt lamp for every 3 foot length instead of the customary one 60-watt lamp per ft.

For some fittings a corrugated glass screen is employed in front of the strip to break up the striations of the light.

We were shown a 300-watt $\frac{1}{2}$ -watt lamp fitted in an approximately parabolic mirror, with one of these screens in front, which gives a beam of nearly 40,000 c.p.

Fig. 4 illustrates a cleverly designed arrangement for foot-lights, which should give a large economy in current compared with the ordinary arrangement. The four rows of tubular lamps have their upper halves silvered, and the light is projected on to a silvered glass reflector of special contour. Fig. 3 shows the arrangement diagrammatically with the polar distribution curve of the light projected on the stage, assuming that 30-watt lamps are employed. The removal of the focus *F* by the reflectors to a point well away from the light source avoids interference between the lines of lamps. Colour effects are produced by hinged screens *A* (shown in Fig. 3 only) instead of by coloured lamps.

The lamps for this fitting, and for other cases in which excessive vibration is expected, have their filaments divided into two lengths, connected by a specially-shaped triple-elliptical spring, and they withstand an extraordinary amount of knocking about.

Fig. 5 is a new departure in dining-room fittings. When pulled down over the table, the lamp comes in the lower part of the double conical reflector, and the light is reflected in the ordinary way on the table. On pushing the fitting up, however, the lamp itself is made to travel up faster than the fitting—by means of a cord absorber—and comes in the upper part of the reflector, so that the lighting becomes semi-indirect for the general lighting of the room. Part of the silk shade is lifted in Fig. 5 to show the form of the reflector.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Boroughbridge.—Messrs. H. Best and W. E. Pullan, of Bradford, are forming a company to carry out an electric lighting scheme for this district.

Bootle.—A twelve months' supply of V.B. wires and cables, lead-covered cables, meters, fuse-boxes, service boxes, and lamps is required. Borough Electrical Engineer. Feb. 17th.

Canada.—The Canadian Electrical Association requires a twelve months' supply of electrical wire, meters, and incandescent lamps. 10, Adelaide Street E., Toronto. Feb. 27th. European firms having no authorised representatives in Canada may cable their prices and other particulars in advance of the date mentioned. Further particulars at 73, Basinghall Street, E.C.

Dewsbury.—An extension of the generating plant is under consideration.

Gillingham.—A loan of £6,750 has been sanctioned for mains and services.

London: Battersea.—Meters and other stores (see advertisement).

Hammersmith.—Twelve months' supply of meters, cable joint and fuse-boxes, and electric light sundries. Borough Electrical Engineer. Feb. 24th.

Manchester.—Six superheaters for the Stuart Street Generating Station. Chief Electrical Engineer. Feb. 22nd.

Redditch.—A L.G.B. inquiry was held last week concerning a loan of £28,000 in lieu of £18,000 originally proposed for electrical extensions. The necessity for increasing the amount of the loan is due to an agreement which has been entered into with the Birmingham Small Arms Co. for a supply up to 2,000,000 units per annum.

Walthamstow.—A L.G.B. inquiry has been held concerning a loan of £15,144 for electrical extensions.

Worcester.—A L.G.B. inquiry was held last week concerning a loan of £5,250 for mains, transformer and sub-station equipment. During the course of the inquiry, Mr. H. R. Hooper, the Inspector, complained that the Corporation had



been again spending money on capital account without sanction. There had, he said, been previous experience of this at Worcester, and a promise had been made that the Corporation would not overspend again. The inquiry also included sums of £1,973 and £850 for the electricity undertaking, but eventually it was adjourned for the Inspector to be furnished with certain particulars.

Wiring

Aberdare.—Wiring and fitting of new police court. Clerk of Works. Feb. 19th.

Barnsley.—Town hall.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Burnley.—School.

Dunfermline.—School.

Finchley.—Hospital for Finchley and Hendon (£50,000).

Loughborough.—Fire station (£5,000).

Oldham.—Theatre. Imperial Theatre Co.

Miscellaneous

Bedwas.—The Bedwas Navigation Colliery Co. requires a twelve months' supply of electrical stores. Secretary.

Maclesfield.—A twelve months' supply of electrical stores for the Cheshire County Asylum. March 10th.

Salford.—Twelve months' supply of metal and carbon filament lamps for the Tramways Department. General Manager. Feb. 22nd.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Eastbourne.—Mr. J. K. Brydges, the Borough Electrical Engineer, has recommended the purchase of a 1,250-kw. Ljungstrom turbo-alternator and condensing plant from the Brush Electrical Engineering Co. at £5,085. The Electricity Committee recommends that the resolution of the Council to purchase a 500-kw. set at £3,200 be rescinded. There was some opposition to the extra expenditure involved, and eventually the matter was sent back to the Committee for further consideration.

London: L.C.C.—Contracts have been placed with the Edison & Swan United Electric Light Co. for drawn wire metal filament lamps under Items 8 to 27 of Schedule 17.

Orient Steam Navigation Co.—A contract has been placed with the Edison & Swan United Electric Light Co. for a 12 months' supply of "Royal Ediswan" lamps.

Winchester.—A contract has been placed with Messrs. C. A. Parsons & Co. for a 500-kw. D.C. turbo-generator at £2,691.

York.—Overhead material for $1\frac{1}{4}$ miles of tramway is to be obtained from Tramway Supplies, Ltd., of Leeds. The poles will be supplied by Messrs. J. Russell & Co., of Wednesbury.

A contract for Osram lamps has been placed with the General Electric Co. by the Bibby line of steamers. The contract is for an exceedingly large quantity of lamps, and was placed after exhaustive tests.

A Trade Misunderstanding.—Mr. E. C. Seear, trading as Seear, Page & Co., 16 and 17 Devonshire Square, E.C., recently sued the General Accessories Co., Ltd. (70 Worship Street, E.C.), before Judge Cluer in the Shoreditch County Court, to recover £26 12s. 11d. for 100 gross of wooden blocks for electric light fittings. The defendants claimed that the price (according to the terms of a circular, should have included finished blocks, whereas unfinished blocks were supplied, as the circular did not expressly say unfinished. Plaintiffs contended that defendants could have known that the price, 5s. 3d. per gross, could only refer to unfinished blocks, as the finished were usually sold at 7s. to 7s. 6d. per gross. Again, it was the custom to deliver unfinished blocks in bags and finished blocks in boxes. Finally the judge decided in favour of the defendants, who were justified in assuming finished blocks unless unfinished were definitely quoted.

Shooting Match.—A shooting match was held at the private miniature range of Siemens Brothers' Dynamo Works, Ltd., Dalston, on Thursday last, between a team representing the firm's lamp works and some representatives of the Press. The result was a win for the Siemens team with ten highest scores aggregating 860 and two others of 51 and 35. The ten highest scores of the Pressmen totalled 738, four others being 47, 46, 45, and 43 respectively.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Flash Lamp Refills.—A correspondent wishes to know the name of the makers of "Franco" and "Standard" flash lamp refills. We shall be glad if other makers of dry batteries for pocket lamps will also communicate with us, as one of our subscribers has orders to place for large quantities.

Bankruptcy.—J. W. Tattersall and T. W. Tattersall, trading as electrical engineers at Kimberley Road, Willesden Lane, N.W., have been adjudicated bankrupts. The first meeting of creditors will be held to-morrow (Friday) at Bankruptcy Buildings, Carey Street, W.C., at 12 noon, and the public examination will take place at the same address on March 16th at 11 a.m.

Agencies.—A manufacturer's agent, already representing several British firms in Russia, is now in the United Kingdom, and wishes to secure the representation in Russia of British manufacturers of electric lamps and fittings.—A Wellington (N.Z.) firm desires to secure the representation of British makers of filament lamps.—A Sydney firm desires to represent British makers of arc lamp carbons, conduits, and electrical accessories. Further particulars in each case at 78 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

The salary of Mr. H. Webber, the Borough Electrical Engineer at Keighley, has been increased from £325 to £400 per annum. In addition, Mr. Webber has a separate salary of £100 per annum as Tramways Manager. There was some opposition, but it was pointed out that the Electricity Committee having previously passed the vote, Mr. Webber had withdrawn his application for another post which he had virtually secured.

Mr. S. W. Carty, Overhead Superintendent to the Liverpool Corporation Tramways, has been given a commission as 2nd Lieutenant in the Army Service Corps, and the Corporation is keeping his position open until his return.

LOCAL NOTES

Batley: Generating Plant Commandeered.—The Brush Electrical Engineering Co. has informed the Corporation that a Ljungstrom turbo-alternator and condenser recently passed for erection at the Corporation electricity works, has been taken over by the Admiralty for an important naval base. The Brush Co. also mentioned that a similar set for the Kensington & Notting Hill Company's joint station in London and a rotary-converter for Kettering have been taken over in the same way. It is understood that these are required for emergency power houses which are being erected to diminish the chance of dockyard work being interfered with through damage to existing stations by hostile aircraft or otherwise. The Company now ask the Corporation to extend the time for the completion of the contract by four or five months. The Town Clerk has been requested to approach the Admiralty on the matter.

London: Marylebone: *Thefts by Meter Clerk.*—A meter clerk named C. Walker has been sentenced to five months' imprisonment for a series of thefts of jewellery and other articles from premises which he visited on the plea of having been sent to make repairs.

Westminster: *Street Lighting Contracts.*—Interesting correspondence has taken place between the Council and the Companies supplying Westminster with lighting in relation to a request that the contract charges should be reduced owing to the reduced lighting which has been enforced by the authori-

ties. The Westminster Electric Supply Corporation points out that it is worse off owing to the darkened streets, as although there was the small saving of about £100 on the current consumed up to Dec. 31st, £666 more had been paid for carbons. Although 123 lamps were out of use no current was saved on this account as it was absorbed in the resistances necessary to keep the other lamps of the series going, the carbons only being saved. The dimming of 224 lamps saved only 15 per cent. of the current which otherwise would be used, the capital charges on maintenance continuing. The Charing Cross, West End, & City Co. is also not disposed to make a reduction for similar reasons.

Ormskirk: *Gas Co.'s Proposal.*—The Ormskirk Gas Co. has a Bill in Parliament this session under which it proposes to acquire the Ormskirk Electric Light Company's undertaking by agreement. The latter Company acquired the Council's Provisional Order of 1910 a short time ago, and is now giving a supply. The Council, however, has indicated its opposition to the scheme.

Wigan: *A German Contract.*—The Electric Lighting Committee has rescinded the acceptance of a tender for switchgear and transformers, it having been discovered that although the capital of the Company concerned was £50,000 only £530 was English money. An English Company has accepted the contract at the price quoted by the German firm.

Yorkshire: *Power Co.'s Bill.*—A conference of local authorities affected by the Yorkshire Electric Power Company's Bill was held at Wakefield last week. The general view of the representatives was that the Company, in return for the authority it asks to supply electricity in those districts in its area where at present there is no supply, should be compelled to prescribe a compulsory area for each particular district. The Company is not prepared to acquiesce in this, but at the same time it is willing to cut out of the Bill any authority desiring to be so treated. There are 84 councils affected, and up to now 33 support the Bill. The County Council has decided to oppose.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Dividends of London Electric Supply Companies.—Westminster Electric Supply Corporation, 8 per cent. per annum for December half year, making 9 per cent. for the year; St. James's and Pall Mall Electric Light Co., final dividend of 5s. per share, making total of 10 per cent. for the year. Central Electric Supply Co., 5 per cent. on the ordinary shares for 1914. Smithfield Markets Electric Supply Co., 2 per cent. on the ordinary shares. South London Electric Supply Corporation, 5 per cent. for the year. London Electric Supply Corporation, 4 per cent. for 1914, placing £12,000 to sinking fund; £10,000 to reserve, £7,000 to contingencies, and carrying forward £8,828.

Arrangements for the Week.—(To-day) *Thursday, Feb. 11th.*—Institution of Electrical Engineers. "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant. 8 p.m.

Friday, Feb. 12th.—Physical Society of London, Imperial College of Science, South Kensington. "On the Criterion of Steel suitable for Permanent Magnets," by Prof. S. P. Thompson, F.R.S. 8 p.m.

Saturday, Feb. 13th.—Birmingham and District Electric Club, Swan Hotel, New Street. "Electric Heating and Cooking Compared with Older Methods," by R. Weaving. 7.30 p.m.

Monday, Feb. 15th.—Institution of Electrical Engineers, Newcastle Section. Mining Institute. Discussion on "Wiring." 7.30 p.m.

Institution of Post Office Electrical Engineers, at I.E.E., Victoria Embankment. "Wireless Call Devices," by L. B. Turner. 6 p.m.

Tuesday, Feb. 16th.—Illuminating Engineering Society, at Royal Society of Arts. "The Development and Design of Lighting Fixtures in Relation to Architecture and Interior Decorations," by F. W. Thorpe. 8 p.m.

Wednesday, Feb. 17th.—Institution of Electrical Engineers, Students' Section. "Modern Power-House Condensing Plant," by A. Arnold. 7.45 p.m.

Thursday, Feb. 18th.—Greenock Electrical Society, at 21 West Stewart Street. "Diesel Engine Testing and Running," by James Richardson. 7.45 p.m.

ELECTRICAL ENGINEERING

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SUMMARY

THIRTY-EIGHT petitions have already been presented against the Electric Power Bill which is being promoted by the London companies. The chief and assistant engineers of all the municipal undertakings in the area have also petitioned (p. 67).

A NUMBER of interesting points on the construction and working of ignition magnetos were raised in a Paper by Mr. J. F. Henderson and discussed at the last meeting of the Institution of Automobile Engineers (p. 68).

WE give some details of the three-phase rack locomotives which are used for towing ships through the Panama Canal locks (p. 69).

STANDARDS for automobile lamps of the tungsten filament vacuum type have been issued by the Engineering Standards Committee (p. 69).

EXPERIMENTS by the staff of the National Physical Laboratory on the heating of buried cables are being carried out on several supply systems under the auspices of the Research Committee of the Institution of Electrical Engineers (p. 69).

A FURTHER list of 140 members of the Institution of Electrical Engineers on Military Service has been issued, bringing the total to 733 (p. 70).

SEVERAL technical books are reviewed on p. 70.

THE effect of change of frequency on the accuracy of alternating-current motors is discussed in our Questions and Answers columns (p. 71).

AMONG the specifications published last Thursday at the Patent Office is one for an arrangement of heating

circuits for preventing a pre-determined load from being exceeded, and a motor with enclosed rotor and open stator. Application has been made for the suspension of an enemy-owned patent for an electrometer used in Röntgen-ray work. An early Marconi patent and one of the Gray tautograph patents expire this week, after a full life of fourteen years (p. 72).

PROF. MARCHANT's paper on the conditions affecting the strength of wireless signals was discussed last Thursday at the London meeting of the Institution of Electrical Engineers. Notes are given under "Telephony and Telegraphy" on the progress in the equipment of automatic telephone exchanges by the Post Office and on the effect of the bombardment on the West Hartlepool telephone exchange (p. 73).

THE L.C.C. are abandoning the side-slot system which had been adopted experimentally (p. 73).

ARTICLES in our Trade Section deal with a boiler feed regulator, a sub-station equipment, a detachable fan, a watertight-door indicator, a rope-operated controller, and an extensible fitting (pp. 74-75).

EXTENSIONS are contemplated at Cleckheaton (£20,000); a 500-kw. turbo-generator is required at Perth; a recommendation to spend £11,000 at Grimsby has been referred back; and various stores are required at Bolton, Bradford, Manchester, West Ham, Belfast, &c. (p. 77).

THE charges for electricity at Wednesbury are to be increased, and there is a prospect of similar action at Dublin (p. 78).

THE South Metropolitan Gas Co., whose own coal steamers were taken over by the Government, have been compelled to pay the present market freight rates to the Government for the use of the interned steamers (p. 78).

OWING to the war, the Yorkshire Electric Power Co. does not feel justified in paying a dividend on the ordinary shares for the second half of 1914 (p. 78).

(For Arrangements for the Week see p. 77.)

The London Electric Power Bills.—Although, as stated in our last issue, there was a slight prospect of the L.C.C. endeavouring to reconsider the vote which resulted in the rejection of its Electric Power Bill, this idea is not being persevered with, and the Bill has now been definitely withdrawn from Parliament.

The second Bill relating to London, viz., that promoted by the Companies, is down for reading on Monday next, but it is probable that it will again be postponed. In the meantime, no less than 38 petitions have already been deposited against the measure, including two on behalf of the Chief and Chief Assistant Electrical Engineers respectively of local authorities supplying electricity in the area scheduled whose undertakings may be acquired under Clause 61 of the Bill.

MAGNETO IGNITION

A PAPER on this subject by Mr. J. F. Henderson was discussed at a meeting of the Institution of Automobile Engineers on Wednesday, Feb. 10th. After a discussion of the elementary principles involved, the author said that the magnets were usually made from tungsten steel hardened by a special process, making them very hard but not necessarily glass-hard. Magnets for this purpose are larger than the bulk of magnets made for instruments, and are much more difficult to harden uniformly, while they must be as powerful as possible while being reasonably permanent, so that even a different steel may be found more suitable for them than for instrument magnets, in which permanence is the first consideration. It was the practice of the author's firm to age magnets for a fortnight before testing to get rid of the sub-permanent magnetisation. A good magnet should give about 200 lines per cubic centimetre. Thus a magnet 32·4 cm. by 4·5 cm. by 1 cm. gave a total flux of 30,000 lines. An interesting point in relation to the permanence of these magnets in use is the fact that by arranging the circuit to be closed only during those parts of the revolution when the current in the armature produces a field assisting the main field, the magnets are being constantly reinforced, and actually tend to become stronger rather than weaker. This was originally pointed out by Mr. B. Murray in 1899 and in the last form of the Bosch contact-breaker, arrangements have been adopted for keeping the contact during two opposite quadrants of the revolution for this reason. Another point, connected with the distortion of the field due to armature reaction, was noticed a few years ago by Mr. Murray, who found that if the trailing tip of the pole piece were made bevelled instead of parallel to the axis of the armature, it had the effect of making the field rotate against, instead of with, the direction of the rotation of the armature, so making the point of maximum current earlier instead of later as the speed of the armature increased. In the Bosch magnetos this result has been attained by using a pole piece of a peculiar shape. Their first arrangement was to make the edge of this pole piece with projecting teeth. As is well known, it is necessary to advance the ignition lever as the speed of the engine increases. The reason for this lies mainly in the lapse of time between the moment at which the points of the contact-breaker are drawn apart and the moment at which the pressure in the cylinders attains its maximum. This becomes a larger proportion of the stroke as the speed increases. The author investigated the effect of the self-induction of the armature on the growth of the current, and showed that it built up quicker the higher the speed. The spark is, however, wanted earlier at high speeds, and if it were not for the fact that the lag of the current gets less at high speed, there would always be a weaker spark as the speed increases. This is a very important result, and it is this which really makes high-speed magnetos possible.

The "high-tension" magneto consists essentially of a low-tension magneto and an induction coil. The primary and secondary are usually both wound together on the armature, the primary being the main armature winding itself. The voltage produced in the secondary, due to its rotating in the magnetic field, is, however, not very great in proportion to the final voltage produced, but in any case it is in the same direction. It was shown mathematically that the discharge from the secondary or ignition circuit is oscillatory in character, and that the more rapid the discharge, the higher is the energy developed, and therefore the temperature of the spark. The resistance and capacity must be kept small to give the greatest number of oscillations, but the capacity must be kept large to get as much heat as possible, so that the resistance must be kept small and the self-induction large. Oscillatory discharges, especially when the frequency is high, have a curious property in that they will jump a spark gap even when there is considerable leakage between the two sides of it, and so, probably, have an advantage for ignition purposes, as a spark would be produced even though the plugs were so dirty as to cause considerable leakage.

The maximum voltage that the magneto can produce will depend on the length of the spark gap at the plug and the pressure of the gas in the cylinder. For a certain length of spark gap the spark will take place at a certain definite voltage, which will be higher as the gap is increased. The spark voltages in ordinary air were given in a table. For example, a 0·02 cm. gap requires 1,150 volts, a 0·1 cm. gap 4,360 volts, and a 0·5 cm. gap 16,800 volts. Under compression the voltage rises almost in direct proportion to the pressure. This produces rather a curious result. With a given plug, the higher the pressure in the cylinder, the better the spark will be, provided the magneto is powerful

enough to make a spark at all. The reason of this is that the voltage will rise higher before the spark takes place, and the work done by the spark is as the square of the voltage. Thus the points of the plug should be kept as far apart as possible to get the best spark.

The connections of a typical magneto system were shown, and the function of the condenser in preventing a harmful spark at the contact-maker was explained. When the condenser is connected up, the current rushes into it and charges it up instead of being wasted in making a spark. The condenser then discharges itself, and produces a current in the opposite direction, round the primary, helping the reverse field. This effect approximately doubles the voltage produced. The secondary of the Bosch magneto is earthed through the primary. This is an unusual arrangement, and in most induction coils it is earthed separately. Another feature to which attention was directed was the safety gap which protected the magneto against excessive voltage should the plugs be disconnected.

There are a large number of variables in the design of a magneto. Assuming the magnets to give 120,000 lines, and allowing a leakage coefficient of 1·3, there will be 108,000 lines through the armature. If the core is increased and the magnets reduced to give the same total induction through the armature, the same voltage would result, but there would be a greater self-induction. This would give a higher voltage when the current is broken, but the lines would build up more slowly in the core, and if the core be increased still further, a point would be reached at which the lines would build up so slowly that there would be no further advantage. Similarly, the more turns put on the primary, the less current will pass, and a point will be reached which will give the maximum ampere turns, which is what is required. Similar considerations affect the secondary. The more turns the higher the voltage, but the resistance and capacity are also increased, which would make the passage of the spark slower. It is necessary, therefore, to find the number of turns which will give the maximum spark. To those who are thinking of manufacturing magnetos, the author said that the importance of the patents affecting them was practically nil. The most important of the Bosch patents applied simply to small details. The question of insulating materials was, however, serious, as most of the best of them came from Germany, though there was no reason why they should not be made in this country.

The discussion was opened by Mr. Young (British Thomson-Houston Co.), who pointed out that permanent magnets were being produced in this country which were the equal of any which had been produced in Germany. He did think that Mr. Henderson's estimate of 120,000 for the total plug of a magneto, which was presumably equivalent to the Bosch Z 24 size, was correct, as with the cross-section of 12 sq. cm. that would give a flux density of 10,000 lines, whereas the actual flux density was about 5,000. Again, he thought that Mr. Henderson's method of defining the goodness of a permanent magnet as 200 lines per cubic centimetre was misleading, as magnets of different length would upset the comparison. It was better to refer to the flux density in the magnet itself. The real point of importance in choosing magnet steel was to see that the coercive force was greater than a certain critical value. He was inclined to doubt that in any circumstances a strengthening of the magnet when in use, and in any case the weight-lifting test, was not a good criterion. He showed an interesting series of oscillograms made by the B.T.-H. Co. The machine tested was a small single-cylinder bicycle magneto, and gave a total flux of 31,000 lines, or, allowing 20 per cent. leakage, a flux density of 5,200. He showed curves giving the variation of self-induction for different positions of the armature, and the current in the primary at different speeds, from which it was seen how the peak was led forward as the speed increased. It was the value of the current at the breaking-point that determined the voltage in the secondary. Owing to self-induction and capacity effects, the voltage in the secondary was much higher than that given by multiplying the primary voltage by the ratio of the turns. It reached 10,000 volts even for very low speeds. Sir Robert Hadfield said a few words on magnet steels, observing that it was remarkable that the addition of tungsten not only made a good magnet steel, but gave a steel of less electrical resistance than the addition of any other element. There was no question that we could make as good tungsten steel here as abroad. English experimenters have studied the effect of heat treatment of these alloys in great detail, and the question of magnet steel was now engaging the attention of a special committee of the Institution of Electrical Engineers. Mr. Watson dwelt on the desirability of formulating a standard test for magnetos. He thought that the most important things to test were the voltage which the magneto would give at low speed and the output in joules at the sparking plug. He thought that oscillographs on the H.T. side were not much use as the current was so small.

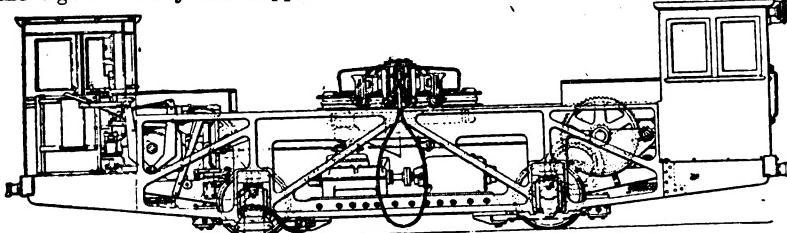
With an electrostatic voltmeter and a very quick-acting contact-maker, he had measured secondary voltages up to 10,000 volts. His measurements showed voltages very nearly in proportion to the turns in the primary and secondary; and he did not quite agree with Mr. Young on that point. He measured the energy output by discharging across a small gap into a large condenser discharging through a resistance and watching the voltage. Mr. Clinker said that Mr. Young's test indicated that 70 to 75 per cent. of the energy stored up in the short-circuited winding was given out by the spark. This had been measured by calorimeter tests. The voltage of a magneto was not proportional to the speed as the curve bent over owing to increasing effect of eddy currents as the speed arose. He did not think that Mr. Henderson's method of testing and measuring the length of the spark was much use. The quality of the "fat" spark that was required was better measured by Mr. Watson's method or by the calorimeter.

Mr. Henderson replied briefly to some of the points raised.

TOWING LOCOMOTIVES ON THE PANAMA CANAL

ONE of the features of special interest in the working of the traffic of the Panama Canal is the use of electric locomotives for towing ships through the locks. At the Gatun locks, for example, the two ship channels, one for traffic in each direction, are separated by a centre wall, and on this wall and on the outer walls are towing tracks fitted with racks as well as tracks for the return of the locomotives. These tracks are for the most part level, but at certain points there are steep inclines, some as steep as 44 per cent., at portions corresponding to the lock-gates. The return tracks are provided with racks on these inclines only, with spring-hinged ramps at their ends. A further feature of the rack-rail is the projecting edges which permit thrust-wheels attached to the locomotive to run along the under side and prevent the overturning of the locomotive, in case some unforeseen operating condition should produce an excessive pull on the tow-line. These thrust-wheels serve to counteract the lateral component of the tow-line pull and the flanges act for emergency only, as the weight of the locomotive is sufficient to prevent overturning with the normal pull of 25,000 lb. on the tow-line. The general system of towing is to have two locomotives on each side ahead of the vessel and two keeping their hawsers tight astern, so that the position of the ship can be regulated to a nicety by the winding drums with which each locomotive is provided.

The principal features of the locomotives can be seen from the figure. They are supplied with current at 220 volts,



SECTIONAL ELEVATION OF TOWING LOCOMOTIVE WITH SIDE COVERS REMOVED.

three-phase, 25 cycles by a double-contact plough in a slotted conduit and the running rails. Each locomotive has two driving axles each driven by its own three-phase slip-ring motor. The wheel-base is 12 ft., and the overall length 32 ft. The drive to the live axle of the adhesion wheels is through two intermediate shafts. The pinion for driving on the rack sections is carried on a sleeve on the axle and driven through another gear from the last gear shaft of greater reduction. These gears are put in action alternatively by sliding sleeve positive clutches of special design, with a spring arrangement enabling them to engage at the right moment automatically without special attention on the part of the driver. Controllers are provided at both ends, and either motor can be cut out if desired.

On each motor shaft is a powerful brake, and as the motors are at all times geared either to the axles or to the rack pinions, the track wheels are not provided with any brake. These brakes are controlled by solenoids, when no current is on the weight of the plunger acting through appropriate levers keeps the brake on; but when the motors are supplied with current, the solenoid holds up the arm and releases the brake. There is, however, a controller stop, on which the brake is released without putting current on the motors for coasting. The brakes can also be applied by

hand to any graduated extent, whether the solenoid is in action or not.

Each of the two main traction motors has a rating of 75 h.p., and is of the slip-ring induction type, operated by a system of contactors with a master controller in each cab. The motors, by means of the change in gearing from straight traction to rack-rail towing previously described, drive the locomotive at a speed of two miles per hour when towing and five miles per hour when returning idle. These motors act as induction generators running above synchronous speed when the locomotive is passing down the steep inclines, and thereby exert a retarding brake effect to keep the speed uniform. The vertical shaft winding drum in the centre of the locomotive is seen in the figure with its pivoted cable-guiding device. The drum can either be driven fairly quickly for coiling-in purposes by a special motor working through bevel gearing, but another motor is also provided for slow running while exerting the maximum pull on the rope, and this works through a worm gear. The bevel-gear motor is always left in gear, but a clutch between the worm gear and the drum enables the other motor to be disconnected during coiling in. The drum is driven through a clutch constructed to slip when a certain pull is exceeded. These motors are each of 20 h.p., and are of the squirrel-cage type. The slow-hauling motor can haul in at 12 ft. per minute, and can take care of sudden pulls on the tow-line up to 40,000 lb., although its normal pull is 25,000 lb. The rapid coiling motor gives a rope speed of 200 ft. per minute.

Each locomotive weighs 86,000 lb. Forty of this type have been supplied by the General Electric of America, and we are indebted for these details to the Company's publication, the *General Electric Review*.

STANDARD AUTOMOBILE LAMPS

A REPORT on British standard tungsten filament lamps (vacuum type) for automobiles has been published by the Engineering Standards Committee. The standardisation of these lamps was undertaken at the request of the Society of Motor Manufacturers and Traders, and a special Sub-Committee took the matter in hand. Lamps of the "vacuum" type with an approximate efficiency of one watt per c.p. only are treated, but it is intended to increase the scope of the report to include the gas-filled lamp of higher efficiency which was recently introduced. The question of whether such lamps should be rated at all in c.p. is receiving the attention of the Committee, and in the meantime they are rated by "actual watts or nominal candle-power." Standard bulbs for head, side, tail, dash, dome, and "festoon" lights are defined, and the standard voltages are given as 6 and 12 volts. The form of the filament is not specified, but for headlights a standard distance of 30 mm. from the contact plates to the centre of the filament is prescribed. The standard small bayonet double-contact cap is to be used for all head, side, tail, and dash lights, and special caps are described for dome and festoon lamps. The headlights range up to 48 c.p. The report (No. 69) can be obtained for 2s. 6d. net.

THE HEATING OF BURIED CABLES

A FURTHER report has been issued by the National Physical Laboratory on the experiments with regard to the heating of buried cables which are being conducted under the auspices of the Research Committee of the Institution of Electrical Engineers. At Bristol, tests have been carried out with cables ranging from 0'05 to 0'3 sq. in. laid direct in the ground, subjected specially to constant loads. The conductor resistance was measured by a bridge method, superimposing on the main alternating current a small continuous current for this purpose. An accuracy of measurement of the order of 0'1 per cent. was attained, but the current could not be kept constant to nearer than one per cent. Determinations were also made of the amount of moisture in the soil at the actual depth at which the cables were laid and of the temperature of the soil. Tests on special loads were also made at Wolverhampton on 0'5 and 0'75 sq. in. cables, one in a duct and the other solid in bitumen. Tests under normal conditions of load have also been made at Marylebone on 2 sq. in. cable carrying about 2,400 amperes for about 14 hours a day, and a special modification of the Callendar temperature recorder is in use on tests at Marylebone with a

number of 1 sq. in. cables in a 20-way duct, and a Wolverhampton with cables laid solid and cables drawn into 4- or 6-way ducts. The full programme of tests has had to be slightly curtailed owing to absence of some of the staff of the N.P.L. on active service.

ELECTRICAL MEN ON MILITARY SERVICE

THE second list of members of the Institution of Electrical Engineers on Military Service has just been issued, and includes 140 names, bringing the total to 733. The first list was published in our issue of Jan. 21st. It must not be assumed that all those on the second list have only just joined; the list includes many with regard to whom the Institution had not yet received particulars when the first list was issued. We give the second list in full below. In the case of members who were in the regular Army or Navy before the war, their rank is given before their name, in other cases after.—

MEMBERS.

A. J. Beckett (2nd Lieut.), W. Casson (Capt.), S. V. Clire-hugh (Corpl.), C. W. Davy (Lieut.-Col.), A. Eden (Lieut.), P. D. Ionides (Lieut.), Admiral Sir H. B. Jackson, K.C.B., K.C.V.O., F.R.S., J. Lustgarten, F. L. McKeever (102nd Regt. Canadian Force), R. K. Morcom (Lieut.), J. J. F. O'Shaughnessy (Major), H. Richardson (Capt.), E. M. Sellon (Lieut., 13th Batt. Canadian Force), C. H. R. Thorn (Capt.), G. R. Webb (Lieut.-Col., 1st G.I.P. Railway Volunteers).

ASSOCIATE MEMBERS.

A. R. Alderson (2nd Lieut.), A. J. Anido, E. G. Anness, H. D. Ash (Lance-Corp.), L. Barber (United Provinces Horse), S. P. Barnes (Lance-Corpl.), L. Barney (1st Class Air Mechanic and Observer, R.N. Air Service), C. R. Bland (Corpl., Calcutta Light Horse), H. W. Bosworth (Anti-Aircraft Corps), H. E. Britton, A. W. Brydon (Lieut.), E. V. Buchanan (Capt., Canadian Engineers), B. E. Bumpus (Bombay Volunteer Rifles), W. Burton, L. S. Challis (Capt.), F. J. Culligan (Calcutta Scottish Volunteers), Eng. Lieut. Commander L. W. Curgenven, R.N., L. H. C. Dermer (Lance-Sergt.), H. Dobell (Lieut.), M. I. W. Ellis (2nd Lieut.), T. Ellis (Lieut.), Capt. A. C. Fuller, R.E., B. C. Gardiner (Capt. Royal Marine Light Infantry), C. L. Goolding, J. Hammersley-Heenan (McGill University Battalion), D. Harrop (Sergt.), H. F. Haworth (2nd Lieut.), J. N. Hindle, C. H. Hird, R. P. Hulton, J. R. Kingston (Lieut.), W. C. C. Langdon, A. B. Layton (Capt.), R. C. Leslie, A. F. Lord (Lieut.), E. M. Marvin (2nd Lieut.), P. T. Maybury (2nd Lieut.), C. N. Moberly (Capt. and Adj't., Bombay Volunteer Rifles), H. E. O'Brien (Capt.), J. H. Palmer (Qmr.-Sergt.), L. S. Payne (Sub.-Lieut.), A. W. Puttick (2nd Lieut., Bombay Volunteer Rifles), A. H. Read, T. E. Robertson (2nd Lieut., Royal Flying Corps, Military Wing), L. G. F. Routledge, R. Shaw, B. H. Smith (Qmr.-Sergt.), W. E. Sotheby, (Motor Driver, British Red Cross), R. J. Spencer-Phillips (Anti-Aircraft Corps), H. D. Stanier (Sergt.), E. J. Stevens (Capt.), H. W. Stovold (Capt.), C. F. D. Suggate (Lieut.), W. Sutcliffe (Lieut.), C. Wade (Motor Driver, British Red Cross), T. S. Wallis, A. G. Watson (2nd Corpl.), G. W. Williamson (2nd Lieut.), C. S. Wolstenholme (Lieut.), E. R. Wynne.

ASSOCIATES.

C. F. Clapham, E. M. Hughman (2nd Lieut. 42nd Deoli Regt., Indian Army), A. B. Robertson (Major), Major N. S. H. Sutwell, R.A., A. M. Wilson, M.D. (Major, Union of South Africa Defence Force, Medical Section).

GRADUATES.

H. I. Booth, W. S. Bracher (Lieut., R.A.M.C.), P. H. Chesterton (1st Calcutta Volunteer Rifles), B. Dees (Capt.), B. Leggett, W. G. McLean (Calcutta Scottish Volunteers), W. G. Stokes, P. A. E. Warburton (New Zealand Engineers), E. M. Wolf.

STUDENTS.

S. G. Anderson (2nd Lieut.), A. Bailey (2nd Lieut.), H. G. Baker, E. Barlow, L. W. E. Baxendell, H. E. Bellamy (Corpl.), H. D. Bennett (Lieut.), P. S. Brett, N. B. Bunt, G. M. Burnand (2nd Lieut.), A. E. W. Butler (2nd Lieut.), E. L. Chadwick, C. S. Coombs, G. F. Davies, F. C. W. Dixon, T. A. F. Dixon, J. W. Elliott (Sergt.), M. O. F. England, William Gilbert, G. Haigh (Lance-Corpl.), F. H. Hayward, J. A. B. Hellaby (2nd Lieut.), C. J. Hews (2nd Corpl.), C. G. Lovegrove, L. A. McDougald (Radiographer, French Red Cross), R. W. Macklin (2nd Lieut.), D. R. McWhinnie (Sergt.), C. E. Maguire, R. Marx (2nd Lieut.), C. W. Miller (Lance-Corpl.), N. H. Miller (Corpl.), L. E. Mold (Lance-Corpl.), A. H. Ogden, H. E. Park, C. F. Partridge (2nd Lieut.), C. E. Penn (Calcutta Port Defence Volunteers, Naval Division), A. E. Power (Lieut.), A. Priestley, W. A. Reeves (Lance-Corpl.), H. P. Richardson, H. Riley (Sergt.), T. H. Solomon, D. C. Stern (2nd Lieut.), H. J. Stone, M. Wadeson (2nd Lieut.), E. H. Webb, L. B. Whitaker (Cossipore Artillery Volunteers), J. G. W. Winn (Lieut.), G. N. L. Woodley (Lieut.), A. W. Wouldham, P. Wrigley.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Papers set in the Qualifying Examination for the Mechanical Sciences Tripos, 1906-1913: 90 pp. 7½ in. by 5 in. 46 figures. (Cambridge: The University Press.) 2s. net; by post, 2s. 2d.

Practical Engineer Electrical Pocket-book and Diary for 1915. 620 pp. 5½ in. by 3½ in. 173 figures. (London: Technical Publishing Co., Ltd.) Cloth, 1s. net; by post, 1s. 3d. Peltine, 1s. 6d. net; by post, 1s. 9d.

Dynamometers. By Rev. F. J. Jervis-Smith, F.R.S.; edited and amplified by C. V. Boys, F.R.S. 267 pp. 9 in. by 5¾ in. 119 figures. (London: Constable and Co., Ltd.) 14s. net; abroad, 14s. 8d.

Alternating-current Electricity and its Applications to Industry. First Course. By W. H. Timbie and H. H. Higbie. 534 pp. 7¼ in. by 5½ in. 389 figures. (New York: John Wiley & Sons; London: Chapman & Hall, Ltd.) 8s. 6d. net; abroad, 9s. 2d.

"Consumers' Accounts and Meter Department Routine." By A. C. Glover. 49 pp. 8½ in. by 5½ in. (London: Electrical Press, Ltd.) 5s. net; abroad, 5s. 3d.

REVIEWS OF BOOKS

High Power Gas Engines. By H. Dubbel. Translated, Edited, and Expanded by F. Weinreb. 206 pp. 11 in. by 7½ in. 428 figures and 18 plates. (London: Constable & Co., Ltd.) 18s. net; abroad, 19s.

Mr. Dubbel's original German work dealt only with large-size double-acting engines, such as have been developed very largely in Germany; but the work before us is more than a translation, as it has been "edited and expanded" by Mr. Weinreb "so as to include British engines and British practice." It is thus a thoroughly suitable book for British gas-engine designers and students, embodying the results of long German experience, as well as the trend of the further advances made in this country. The translator remarks in his Preface that the large gas engine was the outcome of continental enterprise (but we believe we are correct in saying that the real pioneering work was done in France and Belgium, rather than Germany), and continues that the earlier designs were characterised by the prevalence of complicated valve gears mainly influenced by theoretical considerations. The later designs show a compromise between the desire to obtain the theoretical advantage and a tendency towards simplicity. It cannot be denied, he writes, that the latter development is due to the influence of British designers. The work is of a very practical nature, and much of value lies in the very fine collection of detailed drawings of complete gas engines and typical parts.

A School Electricity. By C. J. L. Wagstaff. 250 pp. 9 in. by 5½ in. 181 figures. (Cambridge: The University Press.) 5s. net; abroad, 6s. 5d.

In many ways the writing of an elementary book on electricity is a task requiring more skill than the production of an advanced specialised treatise, and, taken all round, the author has acquitted himself extremely well. His work is the outcome of experience in teaching electricity to schoolboys, and he shows no little originality in the way he presents his subject, casting aside the old "pith-ball" methods and treating electro-statics last instead of first. The whole treatment is based on experimental illustration, and some of the apparatus described is of wonderful simplicity and ingenuity. Each chapter concludes with a series of questions and problems, which appear to be admirably chosen and of a kind to stimulate thought rather than, as is too often the case, mere learning of the text-book by heart.

"Practical Engineer" Electrical Pocket Book and Diary for 1915. 620 pp. 5½ in. by 3½ in. 173 figs. (London: Technical Publishing Co., Ltd.) Cloth, 1s. net; by post, 1s. 3d. Peltine, 1s. 6d. net; by post, 1s. 9d.

A considerable range is covered by this conveniently arranged pocket book, and the additional matter to be found in this year's edition deals mainly with motors, fuses, and wireless telegraphy. A special feature is the section on laws and official rules relating to electrical engineering matters, and at the end of each section there is a short list of books dealing with the part of the subject in question. The information throughout is practical and concise.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,430.

Three rotary converters are run from a six-phase alternator, and are started up through low-voltage tappings. Resistances are inserted in these tappings, and have been burnt out in one rotary. Can this rotary be started up across high-voltage tappings, and if possible, what precautions are necessary in running up? The rotaries have A.C. voltmeters and ammeters on each panel. The alternator is excited by a shunt-wound exciter on the end of the shaft, and the voltage in the alternator is regulated by resistance in the exciter field, and may be further reduced by resistance inserted between the exciter and the rotor of the alternator. The other two rotaries can be shut down whilst running up.—"ROTARY."

(Replies must be received not later than first post, Thursday, Feb. 23rd.)

ANSWERS TO No. 1,428.

A 200-volt, single phase, 10-amp., 41·5 period meter is fixed to register the consumption of a double wire 200-100-volt transformer. As the supply is 200 volts, 83 periods, how will this affect the reading?—J. M.

The first award is given to "OHM" for the following reply:—

Expressed briefly, it is desired to know just what error will result when a 10-amp. 200-volt single-phase induction meter, calibrated for 41·5 cycles per sec., is used on a circuit of twice this frequency, namely, 83 cycles per sec. As the meter is apparently used to measure the energy consumption of a transformer, the current and power factor are likely to vary over very wide limits. As a general rule, a large change in the frequency (even an increase of as much as 100 per cent., such as we are considering) will not appreciably affect the accuracy of a well-designed induction meter over a range of current load between full load and 5 per cent. of full load, provided the power factor is practically unity the whole time. If anything, the meter would register slightly less than it should do on the higher frequency, but the error should not be more than 1½ per cent. over the range of current load considered, if the meter be one of repute. For power factors less than unity, considerable errors will result which will gradually increase in magnitude as the power factor is diminished. In general, an induction meter, when used on a circuit having a higher frequency than that for which it has been calibrated, will register more than it should do on power factors less than unity, providing the current is a lagging one, as is usually the case in practice. This error arises from the fact that on the higher frequency the potential flux penetrating the rotating disc will be "overlagged"; that is, the disc current due to this flux will be brought more nearly into phase with the series flux, so that the resultant torque (and therefore the speed of the disc) will be greater than it should be.

If C =line current, V =line voltage, and $\cos \theta$ =power factor (lagging), then speed of disc= $KCV \cos \theta$, when meter is used in a circuit having a frequency of 41·5 cycles per sec. When used on an 83-cycle circuit we get: speed of disc=

$KCV \cos (\theta - \phi)$, where ϕ =change in phase displacement of potential flux due to increase in frequency. It would probably be of the order of 30°.

On a power factor of 0·5, the error might possibly be as much as 10 per cent., and even for the best-designed meters it would certainly not be less than 5 per cent. The error would be approximately the same at all current loads. For power factors less than 0·5, such as would obtain when the transformer was running light, the error would be greatly enhanced, although it should be noted that under these conditions the actual energy consumption is very small, so that the larger percentage error does not represent a great deal when expressed as £ s. d. The practice of using a meter in the manner suggested is to be greatly deprecated, unless the "lagging" adjustment is properly altered before using the meter on the higher frequency. This adjustment can be easily and quickly carried out on most well known induction meters, and should in every case be made before changing a meter from one frequency to another, unless the frequency change is not greater than, say, 15 per cent.

The second award (5s.) is made to "V. B." who writes as follows:—

It is a matter for experiment rather than theory to say with any certainty what the effect will be on changing over an induction meter to a circuit of 100 per cent. higher frequency than it was originally intended for, as a great deal depends on whether it is an early or late design, although in practice it is generally found that induction meters register on the slow side, with a large rise in frequency. The early design of induction meter was very susceptible to the wave-form of the alternator, and increasing the frequency will cause a preponderance of the harmonic in the resultant wave, which will cause the meter to read slow. The higher the proportion of the harmonic to the fundamental wave, the slower the meter reads.

The effect on the meter disc can be explained by the following:—At the initial testing of the meter the fluxes produced in the disc by the interaction of the shunt and series coils are displaced by an angle equal to the phase displacement of the current and pressure in the supply mains. As the frequency increases the phase displacement becomes larger, until at high frequencies the flux produced in the disc by the pressure coil lags more and more behind the flux produced by the current coil, and produces a negative torque which will oppose the main torque.

It is quite possible that the meter will test out about 8 per cent. slow or thereabouts, or the 100 per cent. increase of frequency. During the last few years meter manufacturers have produced almost the ideal meter, and claim for it accuracy within B.O.T. limit over very wide variation of frequency, and it might happen that on testing out this particular meter on its new frequency that it is within the 2½ per cent. limit on the slow side.

ANSWER TO CORRESPONDENT

G. R. D.—You will probably be able to obtain a copy of the paper in question from the Secretary of the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.

The Electric Vehicle Committee.—At a meeting of this committee on February 5th, it was decided to offer, through the Commercial Motor Users' Association, prizes aggregating £10, to be awarded to electric vehicle drivers in the examinations for drivers which the Association is arranging to hold this year. An offer from the Commercial Motor Users' Association to provide space in the next edition of their "Handbook of Night Shelter Accommodation for Commercial Vehicles," particulars of electric vehicle charging stations and a map, conditional upon the Electric Vehicle Committee preparing the matter, was accepted. As to the standard charging station sign, replies to a circular indicated that about 25 of the illuminated signs and 46 of the enamel plate signs would be required by various undertakings. It was left to the secretary to appoint an official manufacturer of these signs. The Council of the I.M.E.A. has requested the Committee to prepare a report on "The Use of Electric Vehicles in Municipal Service" for discussion at the Convention on June 17th, and to arrange for a parade and demonstration of electric vehicles to follow upon the discussion of the report. The standardisation of lamps for electric vehicles was also discussed.

Western Section of the Institution of Electrical Engineers.—At a special meeting on Tuesday, Feb. 23rd, at 5 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff, at which Sir John Snell will be present, the chairman's address will be given by Mr. D. E. Roberts, and a Paper by C. P. Sparks on "Electricity applied to Mining" will be read. An informal dinner will follow the meeting.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 11th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

26,495/13. Control of Heating Circuits. A. F. BERRY. An arrangement of distributing circuits in premises where a number of heating circuits are used, with the switches controlling each circuit so interlocked that only a number of circuits corresponding to a load less than a predetermined maximum can be on at the same time, although they can be interchanged freely so long as the maximum load is not exceeded. In a modification of the system, all current in excess of a predetermined value can be passed through a separate meter. (Three figures.)

1,133/14. Insulating Material. F. ROWLEY and SANRAINE SYNDICATE, LTD. Electrical and heat-insulating materials made from silk cotton, such as "kapok."

2,174/14. Battery Regulator. A. V. GIFFINS and H. S. WATSON. Automatic regulator for maintaining a constant bus-bar voltage by cutting end cells in and out without altering the number of cells in circuit with the charging dynamo, actuated by solenoids and a ratchet arrangement. (Two figures.)

2,242/14. Dimming Switch. J. H. COLLIE. A three-position tumbler switch with a resistance in the base arranged to put the resistance in series with a lamp, cut the resistance out, or open the circuit. (One figure.)

4,414/14. Resistances. H. COOCH. A variable resistance for motor starters and other purposes in which a liquid or powdered resistance passes from one part of its containing vessel to another, after the manner of the sand in an hourglass. (Two figures.)

8,700/14. Motors. B. GRAEMIGER. Motors for driving enclosed machines in which the use of a stuffing box is avoided by enclosing the starter in a cylindrical case of thin magnetic material of high resistance and great strength, such as a special alloy steel, the walls of which are in the air-gap while the stator is external. (Two figures.)

18,711/14. Wireless Telegraphy. W. C. WOODLAND. A method of increasing the group frequency or tone pitch heard in the receiving telephone by dividing up a multiphase alternating current at the sending end into a plurality of intermediate phases, and energising a corresponding number of oscillatory circuits successively. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WATSON and CALLENDERS CABLE & CONSTRUCTION CO. [Cables] 29,756 and 29,757/13.

Ignition: Soc. CARPENTIER, BAL, ET CIE [Sparkling plugs] 15,380/13.

Instruments and Meters: GIFFORD and NALDER BROTHERS & THOMPSON, LTD. [A.C. moving coil instruments] 1,877/14.

Switchgear, Fuses and Fittings: WERTHEIMER and OROGRAPH PROCESS & RADIANT SIGN CO. [Changeable signs] 8,361/13; DOI [Lamp-holders] 28,421/13; SHAW [Globe holders] 2,713/14; HOLT and SMITH [Switches] 20,796/13; JOHNSON [Automatic fuse] 20,958/14.

Telephony and Telegraphy: AUTOMATIC TELEPHONE MANUFACTURING CO. and SPERRY [Telephone systems] 1,970/14; HAMMOND [Distant control by electric waves] 2,679/14; GALLETTI [Method of producing impulsive discharges] 2,740/14; WESTERN ELECTRIC CO. (Woodward for W.E. CO., U.S.A.) [Automatic telephones] 3,359/14.

Traction: BROWNE [Signalling] 26,855/13; STUART [Electric railway system] 29,759/13; RENAULT [Car lighting] 2,528/14; ROYCE and ROLLS ROYCE, LTD. [Automobile engine starter] 18,829/14.

Miscellaneous: TURQUAND [Electric battery lamps] 2,063/15; WAYGOOD OTIS, LTD., AMPHLETT and WALKER [A.C. electromagnets] 9,093/13; PRESTWICH [Miners' safety lamps] 20,386/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Instruments and Meters: BURKE [Excess wattmeters] 270/15.

Telegraphy and Telephony: CONLEY [Telephone systems] 1,087/15.

Miscellaneous: FILS DE A. PIAT ET CIE [Gravity magneto machine for moulding an article and withdrawing it from the mould] 18,654/14; SIEMENS SCHUCKERTWERKE Ges. [Stray-wave protection for circuits] 723 and 831/15; MEIGS [Electrical apparatus for effecting the chemical combination of gases] 982/15.

The following Amended Specifications can now be obtained:—

Arc Lamps: SIEMENS SCHUCKERTWERKE, 23,188/13.

Telegraphy: H. ABRAHAM [Wireless receiver] 23,113/13.

Application for Suspension

25,101/12. Electrometers. H. BAUR. An application for the suspension of this enemy owned patent, which is for a unipolar static electrometer for determining the hardness of Roentgen-ray tubes, by R. S. Wright and E. E. Burnside, will be heard on Feb. 24th.

Applications for Amendment

16,409/04. Meters. B.T.-H. CO. Application has been made to amend this specification, which is for induction motor-meters, by omitting one of the claims and making other omissions on account of the doubtful novelty of a portion of the subject-matter.

17,487/14. "Wired" Wireless Telegraphy. G. O. SQUIER. Leave is sought to introduce an acknowledgment (at the request of Dr. Erskine Murray, Patentee of No. 15,718/11) of the lack of novelty of the use of a 0'01 mf. condenser on a high-frequency bridge for utilising ordinary telephone lines for "wireless" reception.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

3,481/01. Wireless Telegraphy. J. A. FLEMING and MARCONI'S WIRELESS TELEGRAPH CO., LTD. This describes a complete sending apparatus for long-distance work worked by alternating current, the principal feature of which is the use of a step-up transformer with closed primary circuit and adjustable regulating inductances.

3,570/01. Autographic Telegraphs. P. A. NEWTON (Gray National Telautograph Co., U.S.A.). One form of the well-known Gray writing telegraph or telautograph, in which the position of the sending pen controls two rheostats, and thereby causes currents of varying strength to be sent in two circuits, which reproduce the movements of the pen at the receiving end by the action of two floating coils in magnetic fields.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. HIRST and A. E. ANGOLD [Enclosed arc lamps] 24,566/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: W. T. HENLEY'S TELEGRAPH WORKS CO. and H. SAVAGE [Cables] 22,005/05.

DYNAMOS, MOTORS AND TRANSFORMERS: A.E.G. [A.C. commutator motors] 23,448/07.

Electrochemistry and Electrometallurgy: H. HELPFENSTEIN [Electric furnaces] 24,498/09.

Heating and Cooking: A. TREPREAU [Electric heating] 24,829/09.

Incandescent Lamps: DEUTSCHE GASGLÜHLICHTGES. [Metal filaments] 14,901/06; B.T.-H. CO. (A.E.G.) [Use of water gas as reducing and protecting agent in metal filament manufacture] 24,236/06.

Instruments and Meters: H. CHAPMAN [Photometer] 22,748/08.

Switchgear, Fuses and Fittings: H. ARON [Resistances] 23,279/04.

Telephony and Telegraphy: W. FAIRMENT (Brown Hoisting Co., U.S.A.) [Insulators for aerials] 24,163/06.

Traction: S. E. PAGE (Webber Railway Joint Manufacturing Co., U.S.A.) [Insulated rails] 23,121/03; B.T.-H. CO. (G.E. Co., U.S.A.) [Railway signalling] 23,686/06.

Miscellaneous: A. P. JONES ("Long Arm" System Co., U.S.A.) [Control of watertight doors] 21,679/05; T. J. MURRAY [Electric clocks] 22,819/08; STERLING TELEPHONE & ELECTRIC CO. [Mine exploders] 24,469/09.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Prof. E. W. Marchant's Paper on "Conditions Affecting the Variations in Strength of Wireless Signals," abstracted on p. 61 of last week's ELECTRICAL ENGINEERING, was discussed at the London meeting of the Institution of Electrical Engineers last Thursday. Attention was largely concentrated upon the theories which have been put forward as to the effect of the conditions in the upper layers of the atmosphere. Prof. J. A. Fleming, in a written communication, described measurements of a similar kind to those spoken of by Prof. Marchant, which he had been carrying out in conjunction with Mr. P. R. Coursey. Signals from the Eiffel Tower were received on a Einthoven galvanometer, and the monthly chart showed the same curious variation in signal strength as were recorded by Prof. Marchant. Prof. Fleming's observations showed that the greatest falling-off in the signal strength occurred when the conditions are cloudy both in Paris and in London, but he did not think that any generalisation could be drawn from observations extending over so short a period. Before we could draw valid conclusions, it would be necessary to have an antenna set up near Paris and an automatic record kept of the variations in signal strength occurring close to the sending station. Such an antenna, also, should be in duplicate, one being earthed and the other non-earthed. In the observations so far taken by Prof. Marchant and himself he did not see anything to show definitely whether these variations in signal strength are due to something happening at Paris, London, or Liverpool, or in the region between. He did not believe that in such a short distance as 200 miles the large variations in signal strength which have been observed in London would be entirely due to ionisation of the air. This view was supported by Dr. W. H. Eccles, Mr. Vivyan (Marconi's Wireless Telegraph Co.), Mr. J. E. Taylor, and Prof. G. W. O. Howe. Mr. Vivyan said that observations carried out at the Letterfrack wireless station, eight miles from Clifden, and at Glace Bay, rather tended to the opinion that the reasons for variations in the strength of signals were local at the transmitting station. He mentioned incidentally that it was common for Cocos Island to receive signals from ships in the neighbourhood of Melbourne, a distance of 2,500 miles, which must, he thought, constitute a record for a 1½-kw. station. Dr. Eccles did not think that messages received over a distance of 1,200 miles, as mentioned by Prof. Marchant, were to be regarded as "freak" signals. Samoa was often in communication with vessels off the coasts of Alaska, Mexico, and Chili, and such signals were received practically as an everyday occurrence over a distance of 2,500 miles in summer and 3,000 miles in winter. Mr. J. E. Taylor said he had very little faith in any of the theories which had been put forward as to a supposed ionisation of an upper layer of the atmosphere. There was normally a considerable potential gradient due to atmospheric electric charge, and the exposed antenna should have an appreciable field due to this atmospheric gradient. This superposition of the atmospheric potential gradient had in effect the property of greatly increasing the spread of the electric field from the antenna in an upward direction, and the variations recorded might be due to the fluctuations in this atmospheric field. Admiral Jackson referred to the long distances which it was possible to communicate in the Pacific, and suggested that this would be the most suitable place for conducting the organised observations necessary before a solution of the problem could be looked for. Prof. G. W. O. Howe thought that the theory of an ionised upper layer of the atmosphere was being pushed too far. One investigator attributed weakness in signals to this fact, another strength of signals to the same fact, and, indeed, this cause seemed to be held responsible for almost every variation in the strength. Mr. W. Duddell doubted whether the Einthoven galvanometer was the best for the purpose, and drew attention to a moving coil galvanometer recently constructed by M. H. Abraham, of Paris, which was as sensitive and had several advantages. Mr. Campbell Swinton expressed surprise that Prof. Marchant had obtained such consistent results with the crystal detector, and suggested that there was need of an instrument which would measure the oscillations without the necessity of having them rectified. Prof. Marchant replied briefly.

A review of the work which the Post Office is doing in connection with automatic telephone exchanges appears in

the February number of the *Telegraph and Telephone Journal*. In addition to the Epsom, Hereford, and Darlington exchanges already in operation, representing the Automatic Telephone Co., Lorimer, and Western Electric systems respectively, automatic equipment is being installed in fourteen others. Of these, four will be small village exchanges with an ultimate equipment of fifty subscribers each. They are at Kelvedon, Ramsey, Hurst, and Colnbrook, and all will be on a system specially developed by Siemens Bros. & Co. for this purpose. The equipment can be worked from primary batteries, which is an essential feature for such village exchanges where electric supply for charging secondary batteries is not usually available. This does not quite solve the difficulty, however, for a separate metallic circuit line is necessary to connect each automatic village exchange with its main exchange, and hitherto several villages have been grouped on one line, which is at the same time used for telegraphic purposes. For slightly larger exchanges the difficulty as to power supply is also existent, and the operating expenses of a manual exchange are so small that the high cost of automatic equipment may not often be justified. However, Chepstow (in the Newport area) is to have an exchange on the Automatic Telephone Mfg. Co.'s system, chiefly in order to examine its suitability for such small exchanges, with an initial equipment of 65, and designed for an ultimate of 100. The larger exchanges in which fully automatic equipment is being installed are as follows, the figures after each name representing the initial and ultimate equipment respectively:—Automatic Telephone Mfg. Co.'s exchanges at Accrington (700/1,500), Paisley (1,100/2,150) Newport (1,800/3,500), Blackburn (2,400/4,000), Portsmouth (5,000/7,000), and Leeds (6,600/10,000); Western Electric exchange at Dudley (500/1,600); and Siemens exchanges at Stockport (950/2,260) and Grimsby (1,300/4,000). In addition to this programme, a study of the Sheffield area has been completed, with a view to equipping the whole area on the automatic system, and it is thought that the replacement of the present equipment in the six exchanges in that area will result in a saving of £3,000 per annum. The work of equipment would take about three years from the time it is started. Arrangements are also in contemplation to replace the existing magneto "Central" exchange at Liverpool by a semi-automatic exchange to be erected in the "Bank" exchange building there.

The current number of the *Telegraph and Telephone Journal* also mentions the plucky conduct of the telephone operators at West Hartlepool during the bombardment on Dec. 16th. The West Hartlepool post office (where the trunk exchange is situated) and the local exchange close by were both in the line of fire. When the post office was struck, the operators were requested to take shelter in the cellars, but they remained on duty, as did those at the local exchange, where the traffic, as may be expected, was extremely heavy. In addition to the two operators on duty, assistance was given by the resident caretaker and her two daughters, as well as by two inspectors; they, however, could not cope with the whole of the traffic, which is normally dealt with by three operators. Subscribers were inquiring as to the meaning of the firing, and as to the safety of their relatives and friends. At Scarborough the three operators on duty also stuck to their posts, and urgent military calls to Hornsea, York, &c., were effected through before the wires were shot down and communication ceased. Although all the subscribers did not call up, the indicators on the switchboard all dropped owing to the vibration caused by the bombardment.

A Paper on "Wireless Call Devices" was read and discussed at the meeting of the Institution of Post Office Electrical Engineers on Monday. On the instructions of the Postmaster-General, representatives of the Press were not admitted.

ELECTRIC TRACTION NOTES

The Central London Railway Co. reports that owing to the war, work in connection with the extension between Wood Lane and Ealing Broadway has not progressed very rapidly, and the date of completion will therefore be delayed.

The Annual Meeting and Dinner of the Tramways and Light Railways Association, which is generally held at this time of the year, have been postponed to a date to be fixed.

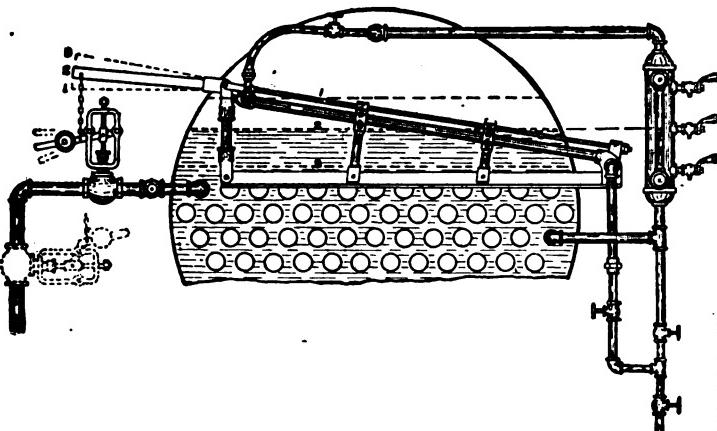
When the L.C.C. built the tramways from Shoreditch to Stamford Hill in 1906, a mile of the line was fitted with the side slot as an experiment. This, however, has not been found satisfactory, and the Committee now recommends that this portion be reconstructed on the centre slot system.

"ELECTRICAL ENGINEERING" TRADE SECTION

THE COPE BOILER FEED REGULATOR

WE have received from Scholey & Co., Ltd. (56 Victoria Street, Westminster, S.W.), a description of an interesting form of boiler-feed regulator on a thermostatic principle which has the advantage over some other systems of not simply keeping the feed-water at a constant level in the boiler, but makes allowance for the fact that on light loads the water should be higher than on heavy peaks. The figure shows the general arrangement. The inclined tube is arranged to contain a varying proportion of steam and water according to the water level. Its mean temperature and, consequently, its length varies, and, acting through a system of levers, these variations in length directly control the feed valve. Suppose the boiler to be normally loaded and the water level to be at the centre of the tube. When an increased load comes on, there is first a slight drop in pressure, and a more rapid liberation of steam from the entire body of water which causes an increase in its volume and a rise of level, which decreases the temperature of the expansion tube and causes it to shorten and the valve begins to close. This is exactly what is desired in order to obtain the maximum capacity of the boiler, since the heat being generated in the furnace is used to generate steam and not to heat feed-water at a time when every pound of steam counts.

As the heavy load continues, the evaporation of water



GENERAL ARRANGEMENT OF COPE BOILER FEED REGULATOR.

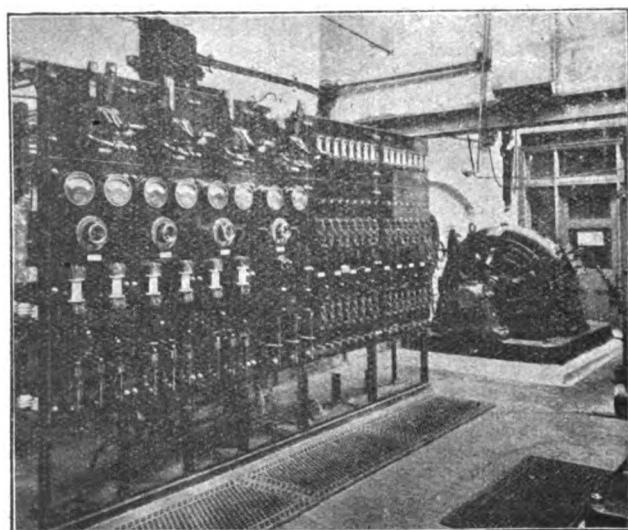
causes the level to drop, and this in turn causes expansion of the thermostat and gradual opening of the feed valve. The level in the boiler drops and the feed valve opens until a point is reached where the rate of feed equals the rate of evaporation and equilibrium is restored, the water being at a new level.

A decrease in load, on the other hand, causes a rise in boiler pressure, causing the fireman to decrease his draught, and this results in a smaller per cent. of steam bubbles in the water throughout the boiler, so that the mixture is more dense and the water level falls slightly, with an accompanying heating up and expansion of the thermostat. This immediately causes the feed valve to open wider and feed the water at a greater rate to the boiler, thus absorbing and storing heat which the furnace would otherwise waste. A decreasing load is then accompanied by a rising water level, since the rate of feed is in excess of the rate of evaporation. The rising level cools the expansion tube and slowly cuts down the feed again, so that at any fixed load position the rate of feed finally becomes just equal to the rate of evaporation and equilibrium is again secured, the water level now standing in the boiler at a somewhat greater height than it did at the normal load.

Railway Ticket Advertising.—A scheme of advertising on the backs of the tickets of the Metropolitan Railway, involving some special designs by John Hassall, has been initiated by S. Davis & Co. (30-31 St. Swithins Lane, E.C.), who have been appointed sole agents to the company for this form of advertising. A new poster calling attention to these ticket advertisements, with the legend, "It's a pity to puncture the picture," also by Hassall, will shortly appear.

SUB-STATION AT A BIRMINGHAM BRASS FOUNDRY

AS they found their existing steam-driven electrical plant inadequate for the growing demand for power in the works, a well-known Birmingham firm of brassfounders and manufacturers of bedsteads, electrical fittings, and similar appliances decided to take power from the mains of the Shropshire, Worcestershire, and Staffordshire Power Co. For the purpose of converting to continuous current the 5,500-volt, 25-cycle, three-phase supply afforded by the power company's mains, they laid down a 150-kw. rotary converter, and the opportunity was taken to instal a new "Witton" main switchboard of the open type. On this provision is made for



150-KW. ROTARY CONVERTER AND SWITCHBOARD IN WORKS SUBSTATION.

three generators and rotary converter panels and all the necessary works' feeders. The "Witton" rotary converter is compound-wound, and runs at a speed of 500 r.p.m., and supplies power at a pressure of 200-250 volts. It is started off low-tension tappings on the transformer in a very simple manner through a switch-panel provided with a three-pole throw-over switch. The converter runs up to speed without any sparking whatever on the continuous-current side and without the provision of any brush-raising device. To prevent high voltages being introduced in the field coils during starting, a field-splitting switch is fixed on the converter shell. The switch is opened during the starting period. The General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), were the contractors for the converter and switchboard.

Ancient Engineering.—Owing to the efforts of the Igranic Engineering Society (Bedford), which consists of members of the staff of the Igranic Electric Co., Ltd., a course of three lectures has been given on Jan. 21st and 28th, and Feb. 4th, by Mr. R. P. Howgrave Graham on Ancient Engineering in Peace and War, with special reference to the evolution and development of engines of war and fortifications. The lectures were held in the Town Hall, Bedford, and were so well attended that a handsome sum, forming the whole of the proceeds, was handed to the Prince of Wales' and Belgian Relief Funds, for the benefit of which the lectures were arranged.

Callender's Hospital and Distress Fund.—Out of this Fund, which is composed of weekly penny subscriptions by the employés, augmented by the firm, directors and other donors, £283 has been contributed to hospitals, &c., during the year, and 288 hospital letters have been issued, 81 surgical appliances supplied, and 17 surgical aid letters were given, in addition to 19 convalescent home letters. Spectacles were supplied in 89 cases. The report states that at the outbreak of war 42 employés joined their regiments, and 127 enlisted since.

British Goods in France.—J. H. Tucker & Co. (King's Road, Hay Mills, Birmingham), have received a letter from a man at the front who has come across some of their electrical accessories in charge of an electrician, who said that he had never had any trouble with them, and asked to have price lists, if printed in French, to be sent to him.

A DETACHABLE FAN

THE fan illustrated in Fig. 1 is a special pattern which the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), have introduced for shipboard and railway train use. The base is provided with a bayonet joint and spring contacts like those of a lamp-holder, so that the whole fan can easily be removed at any time. A clamping ring makes the joint quite rigid. The motors are strongly

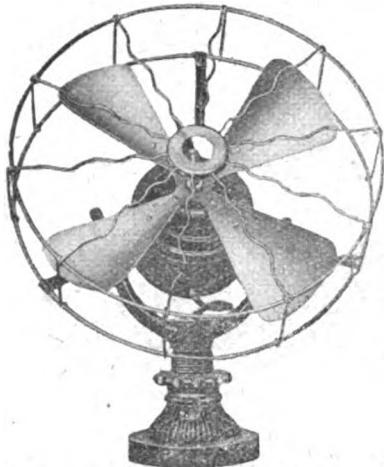


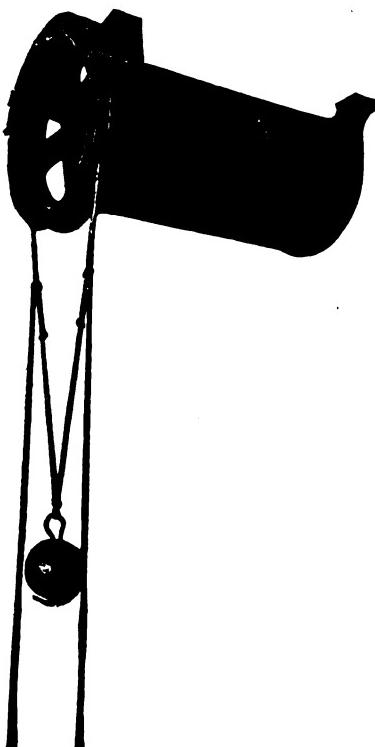
FIG. 1.—SHIP OR TRAIN FAN.

FIG. 2.—FAN REGULATION,
OR DRIVING SWITCH.

made and specially insulated to withstand sea, air, and hot climates. They can be used as ceiling, table, or wall fans.

In connection with these fans, the Company have brought out the simple type of controlling switch seen in Fig. 2. This is made up of a "two-way and off" wedge type tumbler switch fitted with a resistance wound on porcelain, with a ventilated cover enclosing the whole. This can also be used as a dimming switch for metal filament lamps, for which purpose its compactness is a great advantage.

ROPE-OPERATED CONTROLLERS



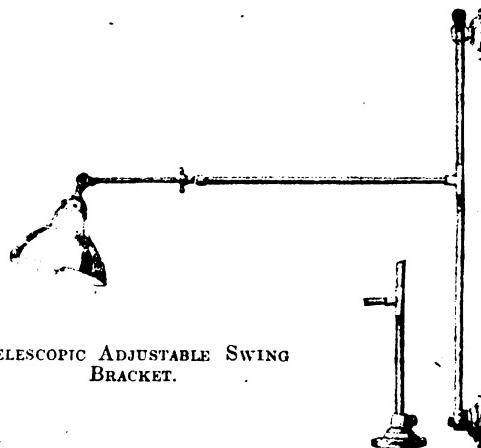
ROPE-OPERATED CONTROLLER.

ROPE-OPERATED controllers are extensively employed on cranes, monorail hoists and other classes of work. The design illustrated, which is manufactured by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), is largely used on Witton-Kramer hoists, and a considerable number have been supplied for the control of motors supported from the ceiling. The controller is the standard "Witton" type, and in the smaller sizes can have the resistance contained inside the controller itself. It is of the reversing pattern, with weight return to the "off" position. This design of controller can be supplied for motors up to 25 h.p. continuous current and 16 h.p. alternating current. It can be provided with electric braking stops if desired.

Obituary.—We regret to announce that Mr. William Bulloch, director of the Electric Construction Co., Ltd., and manager of the Company's Bushbury works, died last week at the early age of 44. Mr. Bulloch has been associated with the E.C.C. for the past twenty years, at first in London.

AN EXTENSIBLE SWING BRACKET

THE simple design of adjustable bracket illustrated here has recently been introduced by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.). The horizontal arm is telescopic, giving a range for the lamp of from 24 in. to 42 in. By means of the wing-nut connection for the lamp-holder and reflector, the angle of the reflector is also adjust-

TELESCOPIC ADJUSTABLE SWING
BRACKET.

able. The telescopic horizontal arm terminates in a T-piece specially cut away in its lower half, so that the weight of the arm causes the T-piece to grip firmly the upright on which it slides. No clamping screw is required, and by holding the horizontal arm this can be moved instantly up or down or swung round in a vertical plane. This bracket may be used as a fixed standard by changing the position of the base-plate, as shown in the illustration. The device is protected by Patent No. 10,814/13.

WATERTIGHT DOOR INDICATORS

IN view of the requirements of the Convention for Safety of Life at Sea, Siemens Brothers & Co., Ltd. (Woolwich, S.E.), have introduced an indicator which enables the opening and closing of each individual door to be observed from the bridge. The indicator consists of a teak case fitted with an enamelled front on which is a plan view of the various decks showing the watertight bulkheads. The positions of the doors are indicated on the plan by means of small circular windows fitted with ruby glass. Electric lamps situated behind the windows are lit by means of special switches operated by the doors when closing, so that the windows are illuminated when the doors are closed. Two lamps are provided for each window as a precaution in case one lamp should fail. A window, illuminated by a lamp fed from the same circuit as used for the door switches, is also provided to indicate when the current is on. The switches operated by the watertight doors are contained in watertight cases and are very strongly constructed. They are operated by levers which are moved by the doors when closing.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—
Members: E. Beninson, C. E. Hunter, F. Samuelson. *Associate Members:* I. S. Dalgleish, H. F. McLoughlin. *Associate Graduates:* P. D. Chawdhry, J. P. Feloy, K. Ito. *Students:* W. H. Allemande, C. Ambler, J. A. A. Best, H. J. S. Brocklehurst, H. Diggle, L. Fossett, F. B. Gibson, W. C. Gomersall, F. J. Heyes, T. E. Houghton, P. B. Kalé, P. Miley, T. R. Mills, E. Stracey-Cheel, G. G. Wardrop, F. J. H. Wilson.

Candidates transferred:—*Associate Member to Member:* C. G. Cadman, A. Moir, R. Rankin. *Graduate to Associate Member:* M. B. Baker, H. C. Turner. *Student to Associate Member:* E. J. Edgar, H. P. Guy, A. C. Sparks, H. K. Whitehorn. *Student to Graduate:* S. Burns, S. M. Hill, H. A. Rickwood.

The Faraday House Journal.—The current number of this journal contains, besides interesting information as to the doings of past and present students of Faraday House, an article by L. Romero on transforming from three-phase to two single phases for single-phase distribution, and some mathematical notes by Dr. A. Russell. Another interesting contribution is by Mr. F. T. Chapman, on Saturation Effects in Alternating Current Apparatus. A supplementary list, with some portraits, of Faadians now serving with the colours is published.

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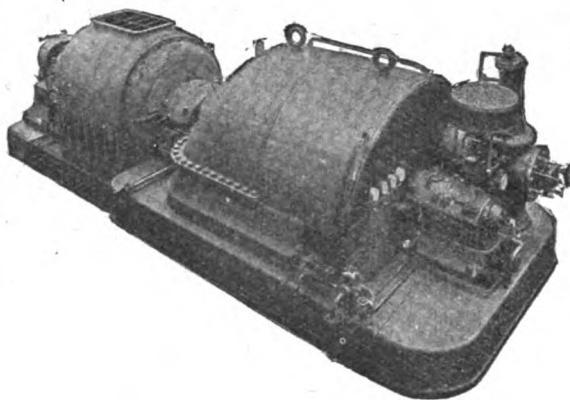
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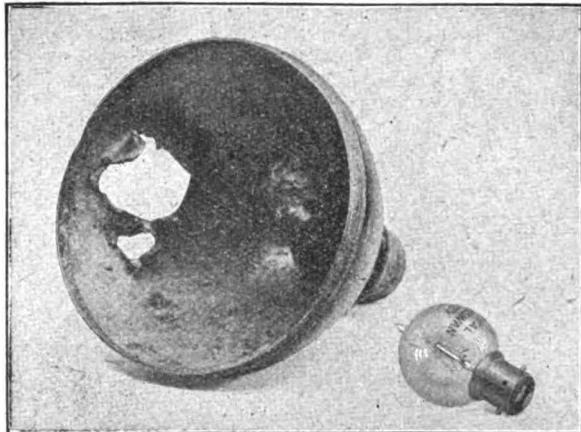
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AN EDISWAN LAMP UNDER FIRE

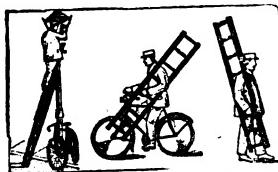
THE shrapnel-riddled motor-car headlamp illustrated here has been sent home by one of the under-foremen of the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), named Private H. Lacy, now serving at the



MOTOR-CAR HEADLIGHT AFTER SHELL-FIRE WITH UNDAMAGED EDISWAN LAMP.

front. The car in question arrived with many shrapnel holes, but with the Ediswan lamps uninjured. The assistant driver reports that half a dozen German shells burst near the car, and the driver was wounded in the back.

A LAMP TRIMMING LADDER



A STRONG but light form of ladder opening to 15 ft. and closing to 6 ft., which can easily be carried after a little practise on a bicycle, is illustrated here. J. H. Heathman & Co. (Parsons Green, Fulham, S.W.) have supplied a large number of these to electricity undertakings.

Sell's Telegraphic Address Directory.—The 1915 volume of this most useful directory consists of 2,600 pages, and contains 80,000 telegraphic addresses registered in the United Kingdom, whilst there is also a representative list of traders in the Colonies and abroad. The classified trade section contains over 100,000 names.

Arrangements for the Week.—*Friday, Feb. 19th.*—Royal Institution. "The Visit of the British Association to Australia," by Prof. H. E. Armstrong. 9 p.m.

Saturday, Feb. 20th.—Royal Institution. "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S. 3 p.m.

Association of Mining Electrical Engineers, Notts Branch. At University College, Nottingham. "Typical Breakdowns in Colliery Electrical Plant and their Prevention," by Lt. Foster. 3.30 p.m.

Lecture on "Firedamp and its Detection," by Prof. McMillan. 6.15 p.m.

Association of Mining Electrical Engineers, West of Scotland Branch. Royal Technical College, Glasgow. "Some Experiments in the Handling of Electricity," by A. Smellie. 4.30 p.m.

Tuesday, Feb. 23rd.—Institution of Electrical Engineers, Western Section. At S. Wales Institute of Engineers, Park Place, Cardiff. Chairman's Address by D. E. Roberts, and "Electricity Applied to Mining," by C. P. Sparks. 5 p.m.

Institution of Electrical Engineers, Manchester Section. Engineers' Club, 17 Albert Square. Discussion on "Training for the Industrial Side of Engineering." 7.30 p.m.

Association of Supervising Electricians. St. Bride Institute, Fleet Street, E.C. "A Practical Talk on Direct Current Motors," by E. T. Butler. 8 p.m.

Institution of Civil Engineers. "The Electrolytic Action of Return Currents on Electric Tramways on Gas and Water Mains; and the best means of Providing against Electrical Disturbances," by H. E. Yerbury. 8 p.m.

Wednesday, Feb. 24th.—Institution of Electrical Engineers, Yorkshire Section. At Philosophical Hall, Leeds. "Electricity Applied to Mining," by C. P. Sparks. 7 p.m.

Institution of Railway Signal Engineers. At I.E.E., Victoria Embankment. "A Review of the Art of Signalling, and Some Suggestions," by A. P. Bound.

Thursday, Feb. 25th.—Institution of Electrical Engineers. "Electricity Applied to Mining," by C. P. Sparks. 8 p.m.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Belfast.—Twelve months' supply of cable and electrical accessories for the Tramways Department. General Manager. March 8th.

Bolton.—Twelve months' supply of motors, motor-starting switches, transformers, meters, joint-boxes, fuse-boxes, &c. Borough Electrical Engineer. March 4th. (See advertisement on another page.)

Cleckheaton.—Extensions at an estimated cost of £20,000 are contemplated. The Electricity Committee reports that it is not prepared to recommend the Council to accept an offer from the Yorkshire Electric Power Co. for a bulk supply.

Dover.—The Guardians contemplate putting down their own generating plant.

Grimsby.—The Electric Lighting Committee's recommendation that a loan of £11,000 be applied for in connection with the purchase of a battery, mains, and services has been referred back. Mr. W. A. Vignoles, the Borough Electrical Engineer, said that the battery was essential, as the station plant is now working up to its maximum capacity. The Chairman of the Committee said he would not remain on the Committee if the battery scheme was not proceeded with. Another Councillor suggested that it would be better to suffer some inconvenience next winter in regard to supply than pay the high interest which is now necessary.

Manchester.—Twelve months' supply of cable, lamps, carbons, &c. Stores Superintendent, Gorton. March 2nd.

Perth.—A 500-kw. turbo-generator is to be installed at an estimated cost of £3,900.

Salford.—Three 1,000-kw. motor converters or rotary converters and transformers, and one 500-kw. motor converter or rotary converter. Borough Electrical Engineer. March 6th. (See advertisement on another page.)

Urmston.—A Sub-Committee has been appointed to inquire into an electric lighting scheme in consequence of complaints of the gas supply.

Wrexham.—Twelve months' supply of meters. Borough Electrical Engineer. March 17th.

Wiring

Aberdeen.—Additions to Bradford Linen Works.

Ilford.—Central library.

Miscellaneous

Bolton.—Twelve months' supply of lamps, carbons, insulating materials, &c., for the Tramways Department. General Manager. Feb. 22nd.

Bradford.—The North Brierley Guardians require 800 incandescent lamps. Clerk, 4 Town Hall Street.

Edmonton.—Six months' supply of electric lamps for Guardians. Clerk, White Hart Lane, Tottenham.

London: Kensington.—Six months' supply of electric lamps and fittings for the Guardians. Clerk, Marloes Road.

Six months' supply of electric lamps, fittings, &c. Clerk, Princes Row, Buckingham Palace Road, S.W.

Newport (Mon.).—Electric lighting fittings. Clerk to Guardians, Queen's Hill. March 2nd.

Richmond (Surrey).—An inquiry is to be made into the cost of street electric lighting.

West Ham.—Three months' supply of electrical fittings. Clerk, Union Road, Leytonstone.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Heywood.—The following tenders have been accepted:—Converting plant, E.H.T. switchgear, and sub-station plant, British Westinghouse Co.; switchboard and cables, Bertram Thomas; battery booster, Phoenix Dynamo Manufacturing Co.; overhead mains, British Insulated & Helsby Cables, Ltd.

Newport (Mon.).—A contract has been placed with Messrs. J. H. Tucker & Co. for a twelve months' supply of electrical accessories.

Plymouth.—A tender by the Brush Electrical Engineering Co. for six car-bodies and trucks at £470 each, and that of

the British Westinghouse Co. for the electrical equipment, have been accepted, subject to the necessary loan being sanctioned.

APPOINTMENTS AND PERSONAL NOTES

A jointer is required for the Swindon electricity works. (See advertisement on another page.)

There are vacancies for a linesman, draughtsman, and an assistant works illuminating engineer.

A Tramways Manager is required at Southampton. Salary £400 per annum. Town Clerk, Feb. 25th.

An electrical foreman is required for Federated Malay States Government Railway. Salary £280, rising to £350 per annum. Preece, Cardew & Snell, 8 Queen Anne's Gate, S.W.

Switchboard attendants are required at Swindon and Blackburn.

LOCAL NOTES

Dartford: *Resignation of Vice-Chairman.*—Councillor Bennett, Vice-Chairman of the Electricity Committee, has resigned both from the Committee and the Council as a protest against what he considers the "sustained policy of opposition, wordy and frivolous to a degree, and which has proved most detrimental to the undertaking." Councillor Bennett's action has been accelerated by recent criticisms upon plans and estimates prepared by the Borough Electrical Engineer, which have been passed by the Local Government Board Inspector and received favourable recommendation from Sir John Snell.

Dublin: *Probable Increase in Charges.*—A special meeting of the Electricity Committee is to be held to consider the estimates for the coming year. It is intimated that an increased rate of charging for current will be necessary to meet the greatly increased expenditure.

Elland: *Current for Cinemas.*—The Council, after interviewing a deputation representing the owners of picture theatres in the town, have agreed to reduce the price for current for cinematograph lanterns to 2½d. per unit.

Epsom: *The "Solid" Mains.*—The Acting Borough Electrical Engineer reports that the old solid mains are in a very bad condition, and likely to break down at any point. His examination has shown that there are very few places where these mains have not been disturbed either by the Gas Company or the telephone authority, whilst in many cases the wood casing has entirely rotted away. Several sections call for immediate attention.

Shop Lighting.—It has been decided only to charge consumers who have contracts for outside shop lighting and maintenance the cost of maintenance and keeping the lamps in order whilst the present restricted lighting conditions are in force.

London: *Woolwich: Loan Periods.*—When Sir John Snell first recommended that the Plumstead works should be closed down, an arrangement was made with the L.C.C. to shorten the term of years over which the cost of the plant at the works was to be repaid. Having regard, however, to the fact that it is now proposed to retain the works as stand-by, the Finance Committee of the L.C.C. is to be asked to suspend the operation of this latter arrangement.

Stoke-on-Trent: *Overdraft.*—In connection with recent

applications for loans, the Local Government Board Inspector pointed out that the Corporation had an overdraft on revenue account of £6,890 on March 31st, 1914, and the Corporation has now been asked what steps it is proposed to take with regard to this. The Town Clerk has given an undertaking that this overdraft will be liquidated during the next three years.

Wednesbury: *Increased Charges.*—In consequence of the Mond Gas Co., which supplies the gas for driving the dynamos at the Council's electricity works, being compelled to revise its schedule of charges, the Electricity Committee has notified its consumers that as from January 1st, 1915, an addition of 15 per cent. will be made to the net amount of all electric supply accounts.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Yorkshire Electric Power Co.—The net profit for 1914 was £20,535 against £15,401 in the previous year. An interim dividend has been paid on the 6 per cent. preference shares, and also 2 per cent. on the ordinary shares. It is now proposed to complete the preference dividend for the year, to write off £2,250 the bonus on second mortgages, to transfer £7,500 to general reserve, and carry forward £5,049. The serious reduction in the current consumed during August and September owing to the war has prevented the directors from paying the dividend on the ordinary shares for the second half-year. During the last three months of the year, however, considerable improvement was made.

South Metropolitan Gas Co.—At the annual meeting last week Dr. Charles Carpenter, the Chairman, referred to the question of coal supplies, and mentioned that 90 per cent. of the Company's own coal vessels have been taken over by the Government. This, he said, he did not complain of, but he was a little surprised that the Government should charge the Company competitive prices, in the present highly inflated market, for the use of the interned steamers to take the place of the Company's own vessels. With regard to the London Electric Power Bills, he said that the gas companies were entitled to ask for a fair field and no favour, and that schemes like the L.C.C., involving the possibility of a call upon the rates, should not be sanctioned by Parliament. An example of the manner in which municipalities conducted electrical undertakings was to go to a large consumer of gas, ascertain by an examination of his account how much he paid per annum, and then offer to supply all the current required in substitution at a price per unit which was specially worked out to come lower than the cost of gas.

London Electric Supply Corporation.—The directors in their annual report direct attention, in view of the repeated statements that London is suffering from the want of a cheap supply of electric power, to the fact that the Company's average receipt per unit sold in 1914 (lighting and power) was 0·94d., compared with 1·04d. in the previous twelve months.

Westminster Electric Supply Corporation.—This Company, which, as we announced last week, is paying a 9 per cent. dividend on its ordinary shares for 1914 compared with 10 per cent. for 1913, reports that the darkening of the streets does not appear to have affected the Company directly, as the amount received from public lighting was practically the same for the two years. The diminution in dividend, however, is accounted for by the reduction in the revenue from shops and private lighting.

Notting Hill Electric Lighting Co.—The loss of revenue last year attributable to the Government war regulations, restricting the lighting in London, was £2,000. Nevertheless the dividend of 5s. per share less tax on the ordinary shares is the same as last year. Under the Company's co-partnership scheme, which came into operation in 1912, the staff received an amount equivalent to an addition of 8 per cent. to wages.

British Westinghouse Co.—Arrangements have been made whereby the French and Italian Westinghouse Companies will be managed by the British Co.



Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £68 to £68 10s. (last week the same).

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, FEBRUARY 25, 1915.

[PRICE ONE PENNY.
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Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

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SUMMARY

AT a conference between delegates of the Electrical Contractors' Association and the B.E.M.A. on the question of municipal powers for hiring out and selling apparatus, there were indications that the E.C.A. will give way on the question of hire-purchase as they have already done on hiring, but they still firmly oppose sale of apparatus by municipal electricity departments. The general situation is also reviewed (p. 80).

AN interesting discussion on "Wiring" took place at Newcastle last week. It was largely devoted to praise and criticism of the cab-tyre sheath system, but other points were dealt with as well (p. 80).

A PAPER read before the American Institute of Electrical Engineers described the Beck searchlight, which has given remarkable results in tests against the standard projectors of the United States Navy (p. 81).

THE proper combination of artificial lighting arrangements with decorative schemes was the subject of a Paper by Mr. F. W. Thorpe read at the last meeting of the Illuminating Engineering Society (p. 82).

THE power Bill promoted by the London electric supply companies is not to be proceeded with this session (p. 82).

In Hull and Manchester, wiremen have asked for an increase of 1d. an hour in wages, and have been offered ½d. increase. In Newcastle 1d. has been offered. In London there is to be a demand for 1½d. increase, but this has not yet been formally made to the Masters' Association (p. 82).

THE cause of a motor frame becoming live in parti-

cular circumstances is discussed in our "Questions and Answers" columns (p. 83).

CONSIDERABLE progress is being made with the conversion of the suburban lines by the L. & S.W. Rly. to electric traction.—A rating appeal with regard to the L.C.C. trams in Islington has been decided in the House of Lords (p. 83).

DAMAGES amounting to £1,100 have been awarded against the Dublin United Tramways Co.—The enlargement of the City & South London Railway Company's tunnels has been suspended owing to the conditions of the money market.—Considerable progress has been made with the electrification of the London & South Western suburban lines (p. 83).

AMONG the subjects of the specifications published by the Patent Office last Thursday is the filling of the interstices of paper cables with oil, and an A.C. system of driverless train control. The Hemming conduit grip patent has been granted in spite of opposition. A patent in connection with lead presses for cable covering expires this week after a full life of 14 years (p. 84).

THE results of Messrs. Lundbergs' recent electric-light switching competition are announced this week; the quality of the Papers was above the average of previous competitions (p. 85).

AN electrical refrigerating plant and an adjustable fitting are described, and notes are given on half-watt lamp installations in our Trade Section (pp. 85-87).

MAINS, converting plant, meters, and switchgear are required at Battersea (£15,750); new plant at Stirling; cable, meters, lamps, &c., at Aberdare, Dover, Islington, and Pontypridd.—Street electric lighting is to be carried out at Leicester (p. 87).

THE Dublin Electricity Committee has decided to increase the lighting charges by ½d. per unit and power charges by ¼d. per unit. Electric cooking apparatus is to be installed in workmen's cottages at Barnes.—An endeavour is to be made to deal with small property at Aylesbury on the fixed charge system (p. 88).

ALTHOUGH the South Metropolitan Electric Light & Power Co. made £1,500 more profit in 1914 than in 1913 no dividend is declared on the ordinary shares.—The Chelsea and Charing Cross Companies maintain their dividends at 5 per cent., and the County of London Co. at 7 per cent. (p. 88).

(For Arrangements for the Week see p. 87.)

Pilot Lamps for Heating Circuits.—The use of pilot lamps on heating circuits is very general in England, but we note from the *Commonwealth Engineer* that in Sydney their use has been made compulsory. The Council has notified contractors that it will not connect up any installation in which provision is made for the use of non-luminous heating apparatus, unless a pilot lamp of small candle-power, with the glass tinted red, is connected in such a way that the lamp must be alight while the current is "on." A pilot lamp must be provided for each separate piece of apparatus.

THE ELECTRICAL CONTRACTOR AND HIS "RIGHTS"

THE Electrical Contractors' Association objects to Municipal Electricity Departments exercising or acquiring powers to sell electrical apparatus or to wire houses, and its members are apparently not too pleased either that Corporations should hire out motors or cookers, particularly if any inclination is shown to do the wiring to them without sub-letting it to a wiring contractor, and they object to hire-purchase by the Corporation. A case has recently arisen for the contractors to show what they can and will do to assist an electricity undertaking which has no wiring, hiring, or selling powers, and it is interesting to see to what extent the contractor is helping. At Oldham the Electricity Department were anxious to extend their power load, but had no powers to hire motors. They therefore, a number of years ago, arranged with a firm of manufacturers (the General Electric Co.) to supply consumers with motors on the hire and hire-purchase system. In all cases the wiring was left to the contractor to do. This worked well for some time, but then the local contractors raised objections through the "Electrical Section of the Oldham Chamber of Trade"—there is only one member of the Electrical Contractors' Association in Oldham. It was therefore agreed that the Electricity Department should in all cases give the local contractors the first option of supplying the motors by referring the consumer to them, but if he could not get his contractor to hire a motor the Corporation would then have it supplied under their arrangement with the General Electric Co. We have no definite record of the number of motors hired out by the contractors after this, but we believe that it was not very great, and, at any rate, the Corporation still found it necessary to continue to hire out a number of motors through the manufacturers so as not to miss new power consumers.

But the position with regard to electric cooking and heating appliances is even worse. Three years ago arrangements were concluded at Oldham with this same Electrical Section of the Chamber of Trade that the contractors should supply consumers with cooking and heating appliances on the hire-purchase system. Up to last July not a single appliance had been supplied on this system, and, in fact, the prices had not yet been formulated. The matter was raised again in January, and the Electricity Department then received a letter from the "Chamber," stating that its Electrical Section "has been in correspondence with a number of makers, and find that, by the rules of their Association, they are precluded from entering into any agreement for the hire of these appliances, but the members of the section have decided to take that business in hand individually." This after the matter had been settled three years ago—so presumably there is as little prospect of the scheme succeeding as in the case of motor-hiring and hire-purchase.

Is it to be wondered at, therefore, that the municipalities with electricity undertakings wish to have full powers to stimulate the demand for power, heating, and cooking by supplying the apparatus themselves?

We have referred to the fact that the Electrical Contractors' Association has but one member in Oldham. The reason is not far to seek. The Association's policy is essentially conservative and not progressive—we use the terms in the literal and not political sense. It takes practically no part in extending the electrical industry. The popularisation of electric light and the introduction and development of electric power, heating, and cooking are left to the supply undertakers and the manufacturers; the chief care of the Association is that its members should enjoy the middleman's profit on business they do not introduce as well as in business they introduce. The wiring contractor whose main business is wiring has little to gain by joining the Association, nor has the contractor established in a town such as Oldham in which the Corporation has no wiring or selling powers. In spite of the very active propaganda carried on by the Association during the past twelve months, in spite of the fixed determination of the municipal electrical engineers to get powers to enable them to concern themselves more with the consumers' installations and the sale and hire of apparatus, the membership of the Association has been increased only by four firms. Last March there were 378 firms belonging to the Association; since then 30 have joined and 26 ceased to be members. It is greatly to be regretted that an Association with clever men at its head should confine practically its whole attention to restricting trade instead of taking steps to increase it. Its main activities are directed to preventing electricity supply undertakings and manufacturers from selling apparatus direct to the users.

Last month the President of the Electrical Contractors' Association met the Acting President of the Incorporated Municipal Electrical Association with a view to arriving at a compromise with regard to the proposals for extending the powers of electricity undertakings to hire and sell fittings, &c. The I.M.E.A. had already given way on many points in order to enable their proposals to be adopted without opposition in Parliament, and their scheme is now practically as follows:—The Corporations are to have power to let out heating and cooking apparatus, motors, &c., on hire or hire-purchase. They will keep large showrooms to interest consumers in extending applications of electricity and put themselves in such a position as to sell the apparatus directly to the consumer if he desires it. To safeguard the contractor from competition with his legitimate business, they offer not to sell anything below the usual market rate; they undertake to do no wiring on the consumer's premises, and to show no undue preference in letting contracts for wiring for which they have been given an order by a consumer. They further offer the free use of their showrooms to contractors who may desire to show a customer any apparatus they have not themselves in stock, and if this results in sales direct from the showroom instead of through the contractor, to give the contractor the whole of the trade discount, and to refer any dispute to arbitration.

It is difficult to conceive a fairer offer, or one more advantageous to both parties; but the President of the E.C.A. will have none of it. The Corporation, he says, must not sell, and must not even let out on hire-purchase; it must not carry out the maintenance of apparatus and installations it lets out on hire; and the Corporation must not place its wiring orders with wiring contractors on the ordinary business basis, but must have a list of contractors (presumably all members of the E.C.A.) to whom the work is to be allotted in rotation.

Obviously the conference between the two parties led to no result.

Since then there has been another conference, this time between representatives of the Electrical Contractors' Association and the British Electrical and Allied Manufacturers' Association, for the B.E.A.M.A. are obviously affected if the sales of motors and other electrical apparatus are throttled by this dispute. At the conference the E.C.A. were inflexible as regards the sale of apparatus, which they contend should only be done by electrical contractors, but they now show signs of giving way with regard to hire-purchase, as apparently they have already done with regard to pure hiring out. But, of course, the imposition of terms and conditions are suggested to safeguard the contractor that hire-purchase is not simple purchase. There seems little reason to doubt that the sympathies of the B.E.A.M.A. will be chiefly with the I.M.E.A., for the members of the latter, if they get the full powers they seek, will be the larger customers for the electrical manufactures which they have to sell.

WIRING

A DISCUSSION on electric wiring occupied the attention of the Newcastle Section of the Institution of Electrical Engineers at their meeting last week.

The discussion was opened by Mr. J. H. C. Brooking, who gave an interesting account of how the Cab-Tyre Sheathed cable had been developed. It was originally evolved to get over the troubles of a prominent Northumbrian colliery company, few of whose trailing cables had hitherto lasted more than six months under the severe conditions of sea-water and rough usage at the coal face. The first Cab-Tyre Sheathed cable was made for this purpose over four years ago, and is still in use. Gradually, however, a demand came for similar cable for other purposes, first by colliery owners and then by others. Mr. Brooking was most emphatic on the durable qualities of this class of material, and offered to eat a piece of cab-tyre (already ten years old) in fifty years' time if it were not then in the same condition as now. After quoting some figures to show that wiring with C.T.S. cable had also low cost in its favour, he dealt next with the question of fittings. With this cable, he said, ordinary standard fittings could be used, but for jobs such as breweries, &c., he had found that the so-called "corrosion-proof" fittings on the market were useless for their purpose. In consequence, his firm had been reluctantly pushed into placing a series of simple non-corrodible fittings on the market, which Mr. J. C. White had designed in porcelain for use with their own cable. These were moisture-proof, corrosion-proof, inexpensive, and easily fitted.

Mr. O. L. Falconer referred to a paper read by him some twelve years ago, in which he had had faults to find with every

system then in use. He thought that, if he were re-writing that paper, it would not be necessary to make many alterations. He had then suggested that some type of armoured cable would eventually be employed, and for wiring purposes cab tyre sheath cable might be looked upon as being armoured. He suggested that manufacturers of new systems should guarantee them for, say, three years, and offer to indemnify the contractor against consequential damages.

Mr. C. Turnbull said many of the troubles of electrical installations were due to sheer carelessness, such as screwing on bends after the wires had been threaded through, and omitting to remove the oil which was used when threading the pipes. He doubted very much if slip joint tubing could be efficiently earthed. The weak point in metallic sheathed cables was leakage on the ends, and in his opinion the ultimate wiring system would be one in which there were no conductors except those for carrying the current. He had used C.T.S. for wiring work, to some extent, and had found it very satisfactory. A disadvantage was that a careless workman was apt to nick the smaller-sized wires when boring, but this could be got over with care. Another difficulty was in ensuring that the sheathing took the weight of the fitting. Finally he suggested that C.T.S. would be much more widely used if the price were more reasonable.

Mr. W. Cross said that he had not had much experience with C.T.S. wiring, on account of the cost, although he admitted that there was nothing better for trailing cables. He asked what guarantees the makers would give that it would withstand the action of wet plaster, over a period of years. He thought that for this work it would be much better to insert a length of tubing, and this also made repairs and extensions a simpler matter. He also asked for further information regarding the effect of continued heat on C.T.S., such as it would be subject to if run on the ceiling of a warm room, and he wanted further information as to its fireproof properties. He suggested that in many cases the cost of wiring work could be reduced quite safely by using cheaper material and workmanship, and said that his experience of C.M.A. cable was that it was not so good as the non-Association quality made by Association makers, and that Association makers were not always able to recognise their own productions; in one case 2,500 megohm grade cables had been submitted for report and had been returned as 300 megohm grade only. Many of the troubles with slip joint tubing, he continued, were due to tubing being placed in contact with gas and water pipes, and he considered that the system was perfectly satisfactory for houses and offices if properly installed, while casing was also satisfactory for thoroughly dry situations. He had had much trouble with screwed tubing and 2,500 megohm grade, due to condensation. The success of any wiring job depended largely upon the workmen, and he would prefer good workmen using bad material to bad workmen using good material.

Mr. W. F. T. Pinkney did not think it a recommendation to say that unskilled workmen could be employed on C.T.S. wiring, for unskilled workmen should not have any hand in wiring at all.

Mr. Gillett said that architects usually looked upon the wiring of a building as a purely secondary consideration, and suggested that examinations for wiremen should be made compulsory. Slip joint tubing was useless in damp situations, and for dry situations had no advantages over casing. He mentioned one 500-light job which was done in casing 18 years ago, and the first fault had developed only recently, whereas a slip-joint job of about the same size had developed faults in less than 15 months. The cost of wiring work, he said, had gone up about 50 per cent. during the last 15 years. With regard to the use of C.T.S. cable on electric irons, he said that the average annual cost per iron per annum for flexible cable was only 4d., and it did not pay to instal an expensive type of flexible. He considered lead-covered wire very unsuitable for the majority of wiring jobs.

Mr. White said that although the cost per job, using C.T.S., might be a little higher than in the case of slip-joint tubing, the fact remained that a staff of workmen could get through more jobs in a given time using the former, and that at the end of the week the balance was in favour of the C.T.S. system.

Mr. W. Baxter said that he had had a good deal of correspondence with Mr. Brooking regarding C.T.S. wiring, and while he agreed that standard fittings could be used in conjunction with C.T.S. wiring, he strongly recommended the issue of a new booklet showing the necessary details. He suggested that Mr. Brooking should approach the architects who did the specifying for large jobs, and who in the majority of cases were content to use the systems which their grandfathers had used before them. Finally, he said that he had conclusive proof, from tests, that rats would not attack C.T.S. wiring.

Mr. Brooking, in the course of his reply to the discussion, dealt first with the suggestion of a guarantee, and said that no one gave them this in connection with any other system. He showed some samples of C.T.S. and other types of cable which had been immersed in a solution of nitric acid at the commencement of the meeting, and it was clearly to be seen that the acid had attacked all the other types of cable, but that C.T.S. was in exactly the same condition as at the start. The

necessity for some method of gripping the sheathing, in connection with the suspension or flexible, was not peculiar to C.T.S. C.T.S. was not exactly fireproof, but if a length of cable was ignited it would not support combustion if held vertically. This had recently been tested by the electrical engineer to a large insurance company, and it had been proved that so-called fireproof wood casing burned quicker than C.T.S. when ignited under the same conditions.

SEARCHLIGHTS

A PAPER by Mr. C. S. McDowell, read on Feb. 18th at the Midwinter Convention of the American Institute of Electrical Engineers, gave some interesting particulars of a new type of searchlight, originating in Germany, which has been tested by the American Navy. In the preliminary part of the Paper the general requirements of a good searchlight projector were summarised and methods of testing the accuracy and absorption of mirrors were described. A searchlight arc should excel in the following particulars:—Small positive carbons with high current densities, and thus high crater temperature throughout the crater area, which gives high intrinsic brilliancy, small negative carbons, long arc length, uniform carbons to secure even burning.

In the new German Beck lamp (which has already been referred to briefly in ELECTRICAL ENGINEERING, Jan. 28th, p. 35) these requirements are met as follows:—Both carbons are rotated for the purpose of keeping their surfaces bathed in the inert gas and to keep the arc central and thus to promote evenness of burning. The positive holder is fixed, and the carbon is fed through it at such a rate that the crater is always maintained at the focus of the mirror. The rate of feed is controlled automatically, a small mirror being placed in the drum which, when the carbon feeds too slowly, reflects a small beam on a thermocouple, and closes a relay circuit which by means of a solenoid quickens the feed. When the carbon is back in focus the small beam of light is off the thermocouple and the feed is slowed down. In addition, the feed may be controlled by hand. The negative carbon feeds through the negative holder in a similar manner, except that the control is by hand. The negative holder is also fixed except when striking the arc, when it is moved up by a striking motor. The lamp is reported to have behaved extremely well on its tests, especially as regards constancy of focus.

In a searchlight the angle of dispersion is directly dependent on the diameter of the source of illumination, provided the focal length is constant, and if the diameter of the source can be decreased one-half while the candle-power remains constant, the intensity of light on the target would be quadrupled. Actually, in the Beck light the positive carbon is reduced one-half, and at the same time the candle-power is increased so that greater efficiencies are obtained. To decrease the angle of shadow it is necessary to increase the arc length or decrease the diameter of the negative carbon. The arc length is restricted to the stability point of burning. The arc length of the Beck lamp is maintained constant at about $\frac{1}{2}$ in. as compared to about $\frac{1}{4}$ in. obtained at 60 volts in the standard 96-in. projector lamp used in the American Navy.

In the Beck arc the ends of the positive and negative carbons are enveloped in the hydrocarbon vapours which prevents the consumption of the carbons at a lower temperature, by keeping oxygen from them; in addition, it cools the outer shell of the carbons, the gas being at a temperature of about $1,000^{\circ}$ C., and thus concentrates the current in the centre of the carbons; thus a current density greater than 0.75 amperes per sq. mm. is obtained, and the whole crater of the positive carbon reaches a very high temperature. The current is brought to both carbons near the ends by roller contacts, so the only part having this high current density is the part protected by the indifferent gas. The positive carbon is cored with a rare earth with a melting point at about $3,500^{\circ}$ C. The positive develops a deep crater, about 12 mm. deep, filled with incandescent gas. The area of the positive carbon is 201 sq. mm., the area of the ordinary 96-in. light positive carbon is 805 sq. mm. In addition to the black body radiation obtained from the crater, there is a large amount of light radiated from the incandescent gas in the crater of a selective nature. The temperature of the incandescent gas within the positive crater is estimated to be between $5,000^{\circ}$ and $5,500^{\circ}$ C.

The light given has a more bluish appearance than that of the ordinary searchlight, and it is claimed that this enables ships of a bluish-grey colour to be picked up more easily. From comparative tests it was seen that the maximum illumination of 44-in. Beck searchlights was $2\frac{1}{2}$ times and

the mean illumination about 5 times as great as a standard 60-in. light. In the Beck searchlight the beam shows a very high illumination at the centre, and falls off rapidly at the edge of the beam. The maximum candle-power obtained with the use of the present American Navy standard carbons is 45,000 candle-power, as against 88,000 candle-power obtained from the Beck lamp.

ELECTRIC LIGHTING AND DECORATION

AT the last meeting of the Illuminating Engineering Society, Mr. F. W. Thorpe read a Paper on the development and design of lighting fittings in relation to architecture and interior decoration. In the first part of the Paper he traced the development of modern fittings from the ancient lamps and later candle fittings, through the various styles of architecture and decoration. Dealing with the decorative side of illumination, he emphasised that "effect" should be considered as well as efficiency in determining the style of fitting to be adopted. There were some cases where the illuminated surroundings constituted the vital point of interest, and it was preferable not to have one's mind distracted by speculations as to the origin of the light illuminating them. In other cases the light source should be made an essential part of the scheme of decoration. Fittings were too often designed with a view to daylight effect, but the brightness of the lamp when alight made it impossible to see the metal-work. The use of modern illuminants in old-fashioned fittings was sometimes considered an incongruity, but, in the author's opinion, if the light source was so shaded as to conceal its nature, the objection disappeared. The lighting of public buildings must be a definite part of the architectural scheme, and the position of fittings must be decided at an early stage. The design of lamp-posts, brackets, &c., for external lighting was equally a matter of architecture, and with certain notable exceptions, such as those in the Mall, this had been sadly neglected. Of late years a great deal of attention had been devoted to the design of fittings with a view to the distribution of light in the most efficient manner, but in many cases the artistic standpoint had been lost sight of. On the other hand, it must be admitted that several types of fittings designed on traditional lines were not particularly efficient as distributors of light.

It was a question how far indirect and semi-indirect lighting could be combined with any of the traditional styles. Indirect fittings of certain periods (Tudor, for example) were sometimes made, and their effect might be pleasing. Yet an indirect fitting in a Tudor manor house, having, perhaps, half-timbered ceilings, however deftly adapted, would be an anachronism. On the other hand, in lighting halls with fine painted ceilings the method is effective provided other supplementary lighting is included to relieve any possibly depressing effect from dark surroundings. Indeed, the use of indirect and semi-indirect lighting should have a distinct influence on ceiling decoration, and it was inconceivable that such methods might give rise to an entirely new method of decorative art. In buildings used mainly by artificial light (theatres, for example) the design of the ceiling had often been expressly adapted to artificial light. Domes had been constructed acting as reflectors, in other cases ceilings and columns of diffusing glass or alabaster had been built in and lamps mounted behind them, and cornice-lighting had been applied in conjunction with decorative friezes.

In the discussion Mr. A. P. Trotter and others emphasised that interior lighting was largely a matter of individual taste, and some difference of opinion was expressed as to how closely the fittings should follow the decorative style. One speaker, Mr. E. P. Warren, said that we could not always be repeating the work of other people, or designing, as he put it, in "inverted commas," and protested against the idea that fittings should be in any kind of obeisance to the style of the building. Mr. P. J. Waldram also mentioned some simple but beautiful designs of fittings which were far from being copies of recognised styles. Mr. C. H. Burt, on the other hand, speaking as a fittings manufacturer, said it was no use designing new types, as he doubted whether they would be accepted by architects as forms which they could embody in their decorative schemes. The same speaker regretted that the voltages at present in use rendered lamps necessary of a size which was not the best from the point of view of fittings design, a point regarding which a particular instance had been mentioned by Mr. A. P. Trotter. Mr. P. Marks thought that the co-operation of lighting specialists with the architects was necessary to obtain the best results—a view that was endorsed by Mr. Penn.

LONDON POWER SUPPLY

The Bill Withdrawn

In referring to the London Electric Power Bills on page 67 of our last issue, we mentioned that there was a probability of the Bill promoted by the electric supply companies being postponed. The Chairman of Committees in the House of Commons subsequently undertook to ask the promoters of any Bill of a contentious character to withdraw it before the second reading stage is reached, the reason being that it is felt undesirable to spend public money in this direction at the present time. In these circumstances the Companies' Electric Supply Bill dealing with London, which was down to be read a second time on Monday, will not be proceeded with this session. The number of petitions against the Bill which we noted last week as 38 finally reached a total of 51.

At the meeting of the St. James's & Pall Mall Electric Light Co. last week, Mr. Walter Leaf, the Chairman, said that whilst not admitting that London even under existing conditions had any reason to be ashamed of the cost of its electricity supply, the directors were prepared to advise the shareholders to sell their property either to the L.C.C. or to an amalgamation at a fair price and on fair conditions. He nevertheless suggested that it was doubtful whether concentration of the whole of London's electricity supply in one or two large power stations would conduce to a sense of public security in present circumstances. He had, however, every confidence in the future of the Company, and the time between now and the end of the war could be well spent in negotiations of one sort or another.

WIREMEN AND WAGES

AFTER the wiremen's strike in London last spring and summer had terminated by the men accepting the code of Working Rules issued by the London Electrical Masters' Association in March at the commencement of the dispute, a joint board of the Masters' Association and the Electrical Trades Union was constituted to investigate complaints with regard to the operation of these rules. The complaints of breaches of the rules were not numerous; all came from the men's side, and, so far as it was possible, were satisfactorily settled. Only four meetings of the Board have been necessary. It is now proposed that the joint board shall continue holding meetings every two months, and that its powers be extended to enable it to suggest any alterations in the working rules that may appear desirable. At a meeting of the London section of the Electrical Trades Union on January 30th resolutions were passed to the effect that application should be made for an advance of wages from 10½d. to 1s. an hour and a 48-hour week, and that the delegates to the joint board should move for the deletion of the "disability clause" and all reference to pipe-fitters and improvers in the working rules—thus practically raising all the issues of last year's strike. On inquiry from the Secretary of the London Electrical Masters' Association, however, we are informed that no application to them has yet been made for the increase in wages and shortening of hours referred to.

In Hull and Manchester, however, the wiremen have asked for an increase of 1d. per hour, and been offered ½d. increase (from 8½d. to 9d. in Hull, and from 9½d. to 10d. in Manchester), and in Newcastle we hear that an increase of 1d. has been offered by the masters, bringing the standard minimum wages to 10½d. per hour.

The National Electric Light Association of America.—The Proceedings of the 37th Convention of this Association held in June last at Philadelphia are published in four large volumes. The first is devoted to reports general and executive sessions and concerning public policy and company matters. Another volume deals with the "commercial" sessions and contains among other things some interesting information on American methods of street lighting. A separate volume is also devoted to accounting. The remaining volume contains most of the technical matter. A special session was devoted to hydro-electric and transmission matters, and some of the latest developments in California and elsewhere are described in the papers and reports. Among other miscellaneous technical subjects treated are electric vehicles, an address on which was given by Dr. C. P. Steinmetz, and the effect of temperature on the power capacity of electrical apparatus. A Paper on the latter subject by Mr. F. D. Newbury describes interesting experiments on the effect of heating on the actual insulation of machines. A very large number of other subjects are treated in the Papers and reports of committees presented.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,431.

I am in a sub-station where 11,500 volts, 25 cycles is transformed down to 550 for tramway service; on the transformer panel there is a watt-hour meter, a power-factor meter, and an ammeter. The voltage is transformed down to 110 volts for those instruments through potential transformers. The watt-hour meter will work all right on full load, but when the load is light it starts to run backwards. Why is this? Please also state if a 50-cycle power-factor meter will work satisfactorily on a 25-cycle circuit.—W. M.

(Answers must be received not later than first post Thursday, March 4th.)

ANSWERS TO No. 1,429.

When the triple-pole switch of a 20-h.p., 3-phase, 40-cycle, 550-volt motor is put in, the motor frame is "alive" (flashing it to earth gives a very visible spark), but when the rotor starter is moved to the first step, and the motor starts up, the frame ceases to be "alive," and remains "dead" as long as the machine continues to run. When the stator windings are tested with a "megger" the insulation resistance to earth is 15 megohms. What is the cause of this? "Erth."

The first award (10s.) is given to "C. S. B." for the following reply:—

"Erth" states that the insulation resistance of the stator windings to earth is 15 megohms. This is a very satisfactory value for a 20-h.p. 550-volt motor, and the fact that the frame is "alive" when the triple-pole switch is closed is certainly not due to any leakage from the stator windings. The insulation resistance of the rotor is not stated. The fact that a spark is seen when flashing the frame to earth may be explained as follows:—The motor is on a fairly highly insulating bed, and there is possibly a leakage from the rotor windings or slip-rings to the shaft—some motors have one slip-ring uninsulated. When the stator switch is closed, the pressure induced in the rotor windings will be approximately 200 volts, and if there is any leakage to the frame the whole motor will be statically charged above earth potential, with the result that a spark will be obtained when flashed to earth. As soon as the rotor starts to revolve, the induced pressure drops rapidly and the effect is no longer noticeable. The motor frame should be connected to earth by a 7/16 S.W.G. copper cable, which will entirely prevent any static charging effects.

The second award (5s.) is made to L. FOXES, who writes as follows:—

If "Erth" tests the rotor insulation resistance of the motor in question, he will probably find that it is defective, and this accounts for the frame of the machine becoming alive when starting up. When an alternating-current motor with a slip-ring rotor is switched on to the line with its rotor at rest, the slip between the rotating field due to the stator and the rotor conductors is a maximum, and therefore the E.M.F. generated in the rotor is a maximum; but as the rotor

increases in speed, so the slip, and with it the rotor E.M.F., become less, until when full speed is reached the slip is only very slightly below that of the rotating field and the E.M.F. across the rotor windings is practically zero, and the ends may be connected together; this is usually done by a proper short-circuiting device which connects all the slip-rings together and earths them with the rotor windings to the shaft of the motor. It will be obvious that any defect in the rotor insulation will be only apparent at starting and at low speeds, but will vanish as the rotor reaches full speed. The frame of the motor should be permanently earthed, otherwise one may receive a severe shock from a machine with defective insulation. If this is a new machine, or if it has been idle for some time, the rotor may have got damp. If the insulation is not zero, the rotor should be thoroughly dried to see if it will improve, and this should be done at once if possible, and before the frame is permanently earthed, as this would probably cause a complete breakdown of the rotor insulation when starting up.

ANSWER TO CORRESPONDENT

"SPEED REDUCTION."—The reduction of load on the motor would roughly be proportional to the reduction in diameter of the driven pulley, assuming that the machines call for the same torque at the reduced speed. In like manner the speed of the lightly loaded shaft can be increased by altering the size of the pulley roughly in proportion to the increase of power allowable on its motor. The pull on the belt in pounds when a certain h.p. is being developed = $H.P. \times 33000 / \pi d^2$ where n is the speed in r.p.m. and d is the diameter of the motor pulley. With regard to the fusing current for different sizes of fuses, this depends chiefly on the diameter of the fuse wire, as the length of the break provided does not affect the fusing current except in so far as it influences the cooling of the wire by the terminal blocks.

ELECTRIC TRACTION NOTES

The directors of the London & South Western Railway Co. in their report for last year state that the electrification of suburban lines has, notwithstanding various difficulties, made steady progress. The main power-house at Wimbledon and sub-stations are practically completed so far as the buildings are concerned, and the machinery is being erected. Some of the rolling stock is also practically complete, and the permanent way of the first section from Waterloo to Kingston is well in hand.

The accounts of the Underground Electric Railways Company of London for the second half of 1914 show a balance of £98,441 after meeting interest on the various classes of debenture stocks and bonds. It is pointed out that the passenger earnings of some of the companies in which the Underground Company is largely interested have been adversely affected by the conditions in London since the war, whilst there has also been an increase in expenditure due to increased wages and cost of material. The enlargement of the tunnels of the City & South London Railway has been postponed owing to the present conditions of the money market.

For more than twelve months the L.C.C. and the Islington Assessment Committee have been at action with regard to the assessment of the tramways in Islington. In 1912 and 1913, owing to the competition of motor-omnibuses, the gross receipts from the L.C.C. tramways in Islington fell from about 11½d. to 9d., and the L.C.C. requested the Assessment Committee of Islington to prepare a valuation of the tramways for rating purposes on the basis of the reduced revenue. This application was refused, and the case has now gone right through to the House of Lords. The argument against the L.C.C. was that the reduction in the revenue referred to did not come within the Valuation (Metropolis) Act of 1869. The Divisional Court decided in favour of the L.C.C., but the Court of Appeal reversed this decision. The House of Lords has now decided in favour of the L.C.C. .

In an action against the Dublin United Tramways Co. last week, a Mrs. Fosbery, the wife of an official of the National Bank, Dublin, was awarded £1,100 damages. The original claim was for £4,000, and the accident in respect of which the action was taken was caused by the plaintiff falling over the shafts of a lorry belonging to the Tramways Company, which, it was alleged, had not been properly lighted, and severely injuring her face.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 18th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

28,421/13. Dimming Lampholder. R. Dor (Japan). Lampholders containing a dimming switch with a resistance in several steps mounted within the barrel of the switch. The rheostat is actuated by turning a knob on the projecting spindle of the barrel. (Five figures.)

29,756 and 29,757/13. Cables. J. F. WATSON and CALLENDER'S CABLE & CONSTRUCTION Co., LTD. The first of these specifications covers the filling of the interstices of impregnated paper-insulated cables with oil to increase the dielectric strength and to decrease the dielectric loss, and the second describes a method of carrying this out by exhausting the air from the cable at one end and forcing the oil in at the other. (One figure.)

29,759/13. Driverless Railways. K. E. STUART (*British and Colonial Pneumatic Tube & Transport Co.*). An alternating-current system of working trains for conveyance of mails, &c., with interlocked sectionalised conductor rails with different supply voltages on different sections to obtain speed variation and auxiliary D.C. conductor rails at certain points for control purposes. (Ten figures.)

1,877/14. Moving Coil Instruments. R. D. GIFFORD and NALDER BROTHERS & THOMSON, LTD. The moving coil in a meter or other instrument, instead of having the current conveyed to it by rubbing or flexible contacts, carries the secondary of a transformer on the moving system in which the current is induced by a suitable fixed primary.

2,740/14. Wireless Telegraphy. R. C. GALLETTI. A method of producing unidirectional impulsive discharges, consisting in coupling a primary circuit containing a discharger, the discharge from which has a tendency to become unidirectional, with a secondary circuit, by a very tight coupling, changing the constants of one of the circuits until the oscillating discharge is transformed into a unidirectional impulsive discharge, and changing the constants of the primary or secondary circuits or of the circuit supplying energy to the primary circuit with the ratio between the current in the secondary circuit, and the current in the primary circuit becoming a maximum within the range of unidirectional discharge.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: GIRARDEAU [Automatic regulation] 7,451/14; HUGHES [Interchangeable carbon holders] 20,999/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: LONGBOTTOM & FARRAR [Conduit tube joints] 4,525/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Protective devices] 4,931/14.

DYNAMOS, MOTORS, and TRANSFORMERS: LEITNER [DYNAMOS] 2,327/14.

Heating and Cooking: BERRY [Heating apparatus] 2,604/14.

Ignition: LONGFORD, LONGFORD and CLARK [Sparkling plugs] 6,800/14.

Incandescent Lamps: GLADITZ [Diamond dies for wire-drawing] 26,353/13.

Storage Batteries: FORD, 10,100/14.

Switchgear, Fuses, and Fittings: SCHWEITZER & CONRAD [Fuses] 3,696/14; PARKINSON, RAILING and GARRARD [Multiple fuses] 20,695/14.

Telephony and Telegraphy: AUTOMATIC TELEPHONE MANUFACTURING CO. (AUTOMATIC ELECTRIC CO.) [Telephone systems] 2,543/14; DUDFIELD [Preventing interruptions on telephones] 5,131/14.

Traction: B.T.-H. CO. (G.E. CO., U.S.A.) [Car lighting] 4,813/14; GLYN [Trolley wires] 6,977/14; RENAULT [Headlights] 15,052/14; HENDERSON [Electrically controlled change-speed gear] 17,885/14; VANDERVELL [Switchboards for motor-cars] 22,176/14.

Miscellaneous: THORNTON [Electric bells] 2,808/14; MORRISON [Electric clutch] 3,455/14; SCHNEIDER [Remote control of guns] 5,966/14; B.T.-H. CO. and DAVID [Control of winding gear] 6,351/14; MAGINI [Roentgen-ray generators] 7,926/14; MELLERSON-JACKSON (INTERSTATE NOVELTY CO.) [Battery lamps] 11,942/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, TRANSFORMERS, &c.: VAN SWAAY [Transformers] 484/15.

DISTRIBUTION SYSTEMS, CABLES, &c.: HOCHSTADTER [Stranded cables] 1,234/15.

TELEPHONY AND TELEGRAPHY: WAGNER [Insulation of telephone cables] 1,346/15.

TRACTION: MASCHINENFABRIK OERLIKON [Electric engine-starters] 180/15.

MISCELLANEOUS: DEUTSCHE TELEPHONWERKE GES. [Detonator for electric waves] 15,881/14; WUILLOT [Combined mechanical and electrical devices] 190/15; CONRAD [Starting electrodes for vapour electric devices] 1,468/15.

Amendments Made

11,091/13. Manufacture of Nitrides. SOC. GENERALE DES NITRURES. This specification, which is for a process of manufacturing nitrides of alumina, &c., in a continuous electric furnace of special design, has been amended by way of disclaimer.

Opposition to Grant of Patents

11,177/13. Telephony. E. R. CORWIN. Opposition to a grant on this specification, which describes a semi-automatic telephone exchange system, has been withdrawn.

26,764/13. Conduit Grip. J. R. A. HEMMING. A grant has been allowed on this specification in spite of opposition. It describes a continuity grip in which a set screw through a lug in the socket has a portion of its thread cut away in boring out the socket, so that a quarter turn is sufficient to cause it to engage with the tube when inserted. This grip was described in ELECTRICAL ENGINEERING, June 18th, 1914, p. 351.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:-

3,972/01. Lead Covering of Cables. E. A. CLAREMONT and S. STRATTON. This specification describes improvements in the construction of the cores and dies of presses for making pipes and covering cables with lead.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: A. E. WOODHOUSE [Flexible metallic casing] 25,577/09.

DYNAMOS, MOTORS and TRANSFORMERS: B. G. LAMME [Single-phase commutator motor with preventive resistances] 23,057/03; B.T.-H. CO. [Rotary converters] 24,336/06; M. C. LATOUR [Variable-speed A.C. motors] 23,916/07; A.E.G. [Commutator motors] 24,135/07; W. P. DURTNALL [Control of A.C. motors supplied by variable frequency alternators].

Electrochemistry and Electrometallurgy: B. SCHMELZER [Metallurgical furnaces] 18,523/08.

Incandescent Lamps: WOLFRAM LAMPEN A.G. [Decarbonising metal filaments] 24,028/07; B. T.-H. CO. and H. H. NEEDHAM [Binder for tungsten filaments] 23,726/08; C. G. REDFERN (COMPAGNIE GENERALE D'ÉLECTRICITÉ) [Attaching filaments] 25,383/09.

Switchgear, Fuses and Fittings: O. KJELLBERG [Relay switches] 22,612/07.

Telephony and Telegraphy: S. P. WILLIAMS [Telephone call meter] 24,165/07; H. VON KRAMER [Telephone system] 25,407/09; H. G. MATTHEWS [Wireless telephony] 25,639/09.

Miscellaneous: J. R. BAKER [Vapour electric apparatus] 22,964/04; A. K. T. SMITH [Electromagnet producing reciprocating motion] 25,144/09.

"ELECTRICAL ENGINEERING" TRADE SECTION

CATALOGUES, PAMPHLETS, &c., RECEIVED

ELECTRIC VEHICLE CHARGING SIGNS.—A leaflet from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), gives prices and particulars of several sizes and varieties of the special illuminated sign for charging stations or garages where charging facilities are provided for electric battery vehicles which has been standardised by the Electric Vehicle Committee.

FITTINGS, &c.—A new list of electric light fittings has just been issued in the convenient octavo form volume of 276 pages, by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.). A very wide and varied collection of brackets, pendants, electroliers, ceiling fittings, table standards, and other fittings are illustrated, and as a preface there is an interesting note upon design as applied to electric light fittings. A number of pages are devoted to shop window and outdoor signs, and a considerable range of silk and other shades and glassware is listed. We are pleased to notice that a full range of plain conical opal shades is included, in view of the difficulty there has been lately in obtaining these. A section at the end of the volume deals with electric heating and cooking apparatus.

IRONCLAD CIRCUIT-BREAKER.—Several patterns of circuit-breakers in cast-iron cases are contained in a new leaflet from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.). Some of these are in flame-proof cases with wide machined flanges for use in fiery mines. Ammeters can be attached. The breaker is of the Company's well-known "Salford" pattern with loose handle feature, and it is interlocked with the lid of the case, which can only be opened when the breaker is out.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—The British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), has issued a new leaflet with prices of Mazda drawn-wire lamps, including the ordinary sizes for high and low voltages, high c.p. lamps, and special lamps such as candle, tubular, sign, and traction lamps.

ELECTRIC FIRES.—The Cressall Manufacturing Co. (40 and 41 Staniforth Street, Birmingham) have issued a list of "Best" electric fires. These include some very elegant designs indeed, and some specimens of the actual apparatus which we have seen reveal perfect finish and workmanship. The Cressall woven glowing resistance strip is used as the heating element.

FITTINGS.—Verity, Limited (31 King Street, Covent Garden, W.C.), have issued a new edition in octavo book form of their electric light fittings catalogue, and a very handsome and well-illustrated volume it is. The range included is so complete that it is impossible to particularise all the classes of fittings dealt with, and indeed even all the novelties. The company emphasises that all the fittings are of their own design and are British in origin in every way. A special feature is the series of hospital fittings, which is very complete, and among the artistic interior fittings we may call attention to a beautiful series of brackets for semi-indirect lighting with real Wedgwood willow pattern screens. Designs to harmonise with every style of decoration are included, and shades, glassware, and accessories are listed separately in profusion.

CALENDAR.—We have received an office calendar from Flowerdew & Co., technical translators, 14 Bell Yard, Temple Bar, W.C.

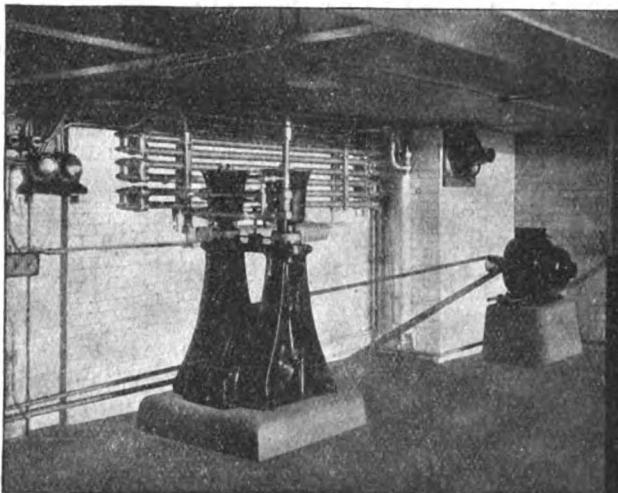
LUNDBERG'S ELECTRIC LIGHT SWITCHING COMPETITION

THE names of those competitors who were successful in passing the examinational tests published in our December issues are given in full on another page. Considering the war, and the large number of young engineers who have responded to the call for their services, the results may be described as entirely satisfactory. We are informed by Mr. W. Perren Maycock, who acted as Examiner on behalf of Messrs. A. P. Lundberg & Sons, that the quality of the Papers was above the average of previous competitions, and we congratulate the successful competitors.

Answer Papers from readers in distant countries may still be sent in, and will be eligible for certificates (but not prizes) if they reach us by June 1st next.

ELECTRICAL REFRIGERATION

THE use of electric motors for driving refrigerating plant is rapidly increasing, as much on the ground of reliability as of economy, and a case where electric motor drive has given satisfaction from this point of view is presented by an installation of the Path-head and Sinclair Town Co-opera-



8-h.p. "WITTON" MOTOR DRIVING AMMONIA REFRIGERATING PLANT AT KIRCALDY.

tive Society, Ltd., Kircaldy, where a 8-h.p. Witton motor is driven by a belt on to the flywheel of a "Hercules" ammonia compression machine. The Society has written the following letter on the subject:—

"The motor with the starting panel was supplied by the General Electric Co., Ltd., and has never given any trouble whatever since the plant was installed some six years ago. It is not an uncommon occurrence to have trouble with motors driving direct on to refrigerating compressors which are single-acting, as a maximum load takes place on the first two or three strokes, and it is often necessary to fit fast and loose pulleys on the compressors in order to allow the motor to get up to speed before putting on the load of the compressor. The motor, however, has never shown any hesitation in starting up at any time, nor has the starting rheostat given any trouble."

HALF-WATT LAMPS AND FITTINGS

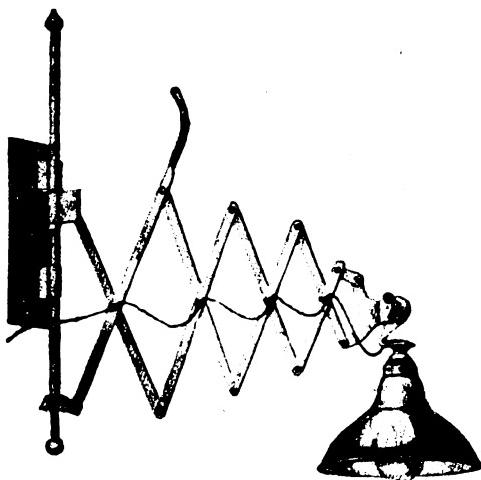
THE intrinsic brilliance of half-watt lamps is too great for them to be used for the older open, direct methods of lighting, and their employment, originally on the score of economy, has led to the wider adoption of indirect and semi-indirect methods of illumination, by which the quality as well as the efficiency of the lighting is improved. A fine example of indirect lighting by half-watt lamps is to be found in the new provision annexe of Selfridges, which is lighted by half-watt lamps in B.T.-H. "eye-rest" fittings, giving a fine effect. Now that half-watt lamps are available in considerable quantities for prompt deliveries, increasing attention is likely to be paid to this form of lighting, lamps and fittings for which are a speciality of the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.).

The Enemy's Trade.—The Commercial Intelligence Branch of the Board of Trade continues to receive numerous inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. This Branch is now issuing lists of such articles weekly. Those interested should apply to 73 Basinghall Street, E.C.

German Firms in France.—*La Lumière Electrique* publishes a list of 77 electrical and engineering firms owned wholly or partly by Germans or Austro-Hungarians, which have been put under Government receivership. Some very well-known names are included.

AN ADJUSTABLE FITTING

THE fitting illustrated here, which has recently been introduced by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), is particularly suitable for business offices, drawing offices, &c., where a wide range of adjustment of position is desired. By a "lazy tongs" action the



LAZY-TONGS ADJUSTABLE BRACKET.

projection is adjustable between 8 in. and 32 in., and there is a horizontal swivelling action within a semi-circle. The angle of the reflector is also adjustable, as shown by the wing nut provided. By means of the curved extension of one of the arms of the lazy tongs, which can be hooked on to the wall pillar, the light can be raised to a fixed point 27 in. above the normal position. The fitting, which is the subject of Patent No. 15,607/13, is made of polished brass.

EXPERIENCES WITH HALF-WATT LAMPS

WE have received the following letter from Mr. F. C. Morris regarding the life of half-watt lamps in actual use:

I beg to enclose a report relating to the life of four 1,000 c.p. 500 watt half-watt lamps.

At our steel works (John Booth & Sons, Hulton Steel Works, Bolton), we have had continually, during the past twelve months, a day and night shift, and these lamps have been fixed at a height of 35 ft. from the ground. The light is extremely satisfactory, the chief advantage being that the cranes are kept continually at work, there being no need to stop them, which was a common occurrence when trimming arc lamps.

Life of two Half-watt Wotan Lamps, 115 volts, 500 watts (in series).—Fixed April 6th, 1914 : April 6th, 1914, to Aug. 1st, 480 hours; Aug. 15th to Oct. 1st, 230; Oct. 1st to Dec. 30th, 560 hours. Total burning hours, 1,270. One burnt out Dec. 30th, 1914.

Two Half-watt Wotan Lamps, 115 volt, 500 watt. (Series fixed May 13th, 1914).—May 13th to June 8th, 108 hours; June 11th to Aug. 1st, 180 hours; Aug. 18th to Oct. 1st, 230 hours; Oct. 1st to Dec. 30th, 560 hours; Jan. 1st to Feb. 15th, 380 hours. Total burning hours, 1,458. These are still in use.

Arrangements for the Week.—(To-day) Thursday, Feb. 25th.—Institution of Electrical Engineers. "Electricity Applied to Mining," by C. P. Sparks. 8 p.m.

Friday, Feb. 26th.—Physical Society. At Imperial College of Science, South Kensington. "The Electrification of Surfaces as Affected by Heat," by Dr. P. E. Shaw. 5 p.m.

Saturday, Feb. 27th.—Association of Mining Electrical Engineers. South Wales Branch. Carlton Café, Queen Street, Cardiff. "Typical Breakdowns in Colliery Electrical Plant and their Prevention," by Ll. Foster. 6 p.m.

Monday, March 1st.—Institution of Electrical Engineers, Newcastle Section, Mining Institute. "Electricity Applied to Mining," by C. P. Sparks. 7.30 p.m.

Wednesday, March 3rd.—Institution of Electrical Engineers, Birmingham Section. At University. "Electricity Applied to Mining," by C. P. Sparks. 7.30 p.m.

Institution of Electrical Engineers. Students' Section, at Victoria Embankment. Discussion on "The Application of Electrical Engineering to Warfare." 7.45 p.m.

Thursday, March 4th.—Greenock Electrical Society. 21 West Stewart Street. "The Operation of a Large Electric Supply System," by G. Macdonald.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aberdare.—Twelve months' supply of cable, meters, joint-boxes, lamps, &c. March 6th.

Dover.—Twelve months' supply of cable and electrical sundries for the Harbour Board. March 9th.

London: Battersea.—The Finance Committee of the L.C.C. recommends sanction to the borrowing of £15,750 for mains, converting plant, and switchgear. Tenders have been invited for twelve months' supply of meters, joint-boxes, metal and carbon filament lamps, troughing, &c. Borough Electrical Engineer. March 2nd.

Stirling.—Extensions are to be carried out at the generating station, and Mr. J. A. Robertson, Borough Electrical Engineer at Salford, is to be consultant.

Swindon.—Twelve months' supply of meters, fuse- and service-boxes, &c. Borough Electrical Engineer. March 13th.

Wistaston.—Mr. H. H. Denton, Borough Electrical Engineer at Crewe, is to report to the Nantwich Rural District Council with regard to an electric lighting scheme for this district.

Wiring

Edinburgh.—Labour exchange, Grassmarket. City Electrical Engineer. March 4th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Derby.—Infirmary (£35,000).

London: Wandsworth.—Coroner's court (£2,500).

Manchester.—Four public wash-houses (£16,000).

Nottingham.—Children's homes, &c. Architects, Vallance & Westwick, Mansfield.

Miscellaneous

Dundee.—Twelve months' supply of armature coils, commutators, carbon brushes, lamps, and other stores for Tramways Department. General Manager. March 3rd.

Leicester.—Incandescent electric lighting by 600-c.p. half-watt lamps has been recommended by the Watch Committee for certain tramway routes.

London: Islington.—Twelve months' supply of electrical fittings. Clerk, St. John's Road, Upper Holloway, N. March 9th.

Mile End.—Twelve months' supply of electrical fittings for the Guardians. Clerk, Bancroft Road. March 2nd.

Pontypridd.—Twelve months' supply of joint-boxes, cut-outs, tramway equipment, insulating material, meters, &c. Borough Electrical Engineer. March 18th.

Richmond (Ireland).—Twelve months' supply of electric lamps and fittings for the Asylum. Clerk, Grangegorman Annexe, Dublin. March 10th.

TENDERS RECEIVED AND ACCEPTED · AND ORDERS PLACED

The General Electric Co. of China has secured the contract for all the Government requires for Osram lamps and electrical supplies for Hong Kong for 1915.

The Edison & Swan United Electric Light Co. has received a contract for Royal Ediswan metal and carbon filament lamps from the Booth Steamship Co.

APPOINTMENTS AND PERSONAL NOTES

Mr. H. W. Miller has been appointed Managing Director of the Kensington & Knightsbridge Electric Lighting Co. in succession to Mr. R. W. Wallace, K.C., who has resigned.

We regret to record the death on Sunday of Lance-Corporal J. A. Donald, late of the Blackpool Electricity Works, who with two other members of the staff had joined the Royal Naval Division through the I.E.E. He died suddenly of myocarditis while on leave. We hear that there are now

64 members of the Blackpool electricity and tramway undertaking serving in H.M. Forces.

An Assistant Electrical Engineer is required by the Redditch District Council. Commencing salary £170 per annum. Town Clerk. March 11th.

Mr. W. J. Appleby, of Birmingham, has been appointed Shift Engineer at Watford at a commencing salary of £90 per annum.

A meter-room assistant is required at Stepney, a switch-board attendant at Ipswich, and carshed fitter at Swindon.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £59 5s. to £59 15s. (last week, £68 to £68 10s.).

Agencies.—An agent in Archangel desires to represent British manufacturers of electric lamps and fittings.—An engineer in Ekaterinoslav (Russia) desires to represent British manufacturers of motors and electric light plant.—A Christchurch (N.Z.) firm wishes to represent British manufacturers of small motors, dynamos, metal filament lamps, &c. Further particulars in each case at 73 Basinghall Street, E.C.

Liquidations.—A meeting of the Ebro Light & Power Construction Co. will be held at 232 Strand, W.C., on March 22nd, at 2 p.m., to hear the liquidator's account of the winding-up.

LOCAL NOTES

Aylesbury: Progress of Electrical Undertaking.—Considerable headway is being made with the Council's electric supply scheme. The engine foundations are in place, and the generating plant has been delivered. The Electric Lighting Committee has been advised that, in view of recent legal decisions, the supply by the Council of wiring and fittings cannot be undertaken, and the Resident Engineer has been instructed to report upon methods of dealing with the supply to small houses at a fixed price.

Barnes: Electric Cooking.—It has been decided to instal electric cooking apparatus in a number of the Council's workmen's dwellings. The cooker is to consist of a small oven and boiling plant. Prepayment meters will be used, and the charge for current will include 3s. 6d. per annum for the hire and maintenance of the apparatus.

Dover: Electrical Extensions.—Our contemporary, the *Dover Express*, is complaining of the proposed expenditure of £6,000 for extensions to the electricity undertaking, on the ground that the Chancellor of the Exchequer intimated, at the beginning of the war, that expenditures which could be avoided at present should not be incurred. It is difficult to see, however, how the increased expenditure at Dover on necessary extensions to the electrical plant comes under this heading, but, in any case, at the L.G.B. inquiry all the details of the proposal will be investigated into.

Dublin: Increased Charges.—We referred in our last issue to the fact that the Electricity Committee was to hold a special meeting to consider the question of increased charges owing to the extra cost of coal, &c. This meeting was held on Thursday, when it was reported that the increased expenditure during the next twelve months is estimated to be £20,000, of which coal is responsible for £15,000. The Committee, however, was reluctant to increase the charges to bring in this extra revenue, as the City Electrical Engineer believes that by postponing certain work and effecting changes in certain directions he will be able to meet a portion of this

extra cost. Eventually it was decided to recommend the Corporation to increase the lighting charges by ½d. per unit and the power charges by ¼d. per unit.

Hornsey: Electricity Deficit.—A resolution was moved at the last meeting of the Council that £2,750 should be taken for relief of rates from the surplus of £6,915 standing to the credit of the electricity undertaking. The mover of the resolution argued that as the undertaking had received in the early years of its existence £6,736 from the rates, it was time that some portion of this sum was repaid. The Chairman of the Finance and Electricity Committees, whilst agreeing that the undertaking was in honour bound to repay the sum received from the rates, did not think that the present was the most opportune moment, and eventually it was left to the two Committees to confer and bring forward a scheme later.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Companies Struck Off Register.—The names of the following have been struck off the register of joint stock companies:—Electrical Power Users' Association, Ltd.; Electric Fire Prevention Appliances & General Manufacturing Co.; International Syndicate for Works Concessions, Ltd.; the Star Electric Light Co., Ltd.; British Wireless Telegraph Syndicate; Electrical Fittings Co.; and the National Electric & Motor Corporation, Ltd.

The names of the following will be struck off the register of joint stock companies at the end of three months unless cause is shown to the contrary:—Alkaline Accumulators Paul Gouin, Ltd.; County Electric Traction Co.; Electric Batteries and Carbons, Ltd.; Leeds Electric Co.; Southwold Electricity Works, Ltd.; and the Witney Electric Supply Co.

Bastian Meter Co.—A dividend of 2 per cent. on the ordinary shares is recommended for 1914.

Scarborough Electric Supply Co.—In their report for 1914 the directors express their regret at the loss sustained through the death of the Company's secretary in the bombardment of Scarborough by the German fleet at the end of the last year. A dividend of 2 per cent. is recommended on the ordinary shares.

South Metropolitan Electric Light & Power Co.—The net revenue for 1914 was nearly £1,500 more than in the previous year, notwithstanding the restricted lighting and general disturbance of business by the war. The directors indicate that they are not prepared to support the Power Bill promoted by the other London companies. The sum of £10,000 is added to reserve, and £5,591 carried forward. No dividend is declared on the ordinary shares.

Bruce Peebles.—There was a net profit for 1914 of £3,892 after meeting mortgage interest. No dividends are declared.

Tramways, Light & Power Co.—This Company, which took over the power companies working in Leicestershire, Warwickshire, Derbyshire, and Nottinghamshire, a short time ago, proposes to issue a further £100,000 in preference shares, bringing the nominal share capital to £700,000.

Chelsea Electricity Supply Co.—A dividend of 5 per cent. is recommended on the ordinary shares for 1914, the same as in 1913. A slightly larger allowance has been made for depreciation, and the sum of £3,196 is carried forward as against £2,765.

Bournemouth & Poole Electricity Supply Co.—The recent issue to shareholders of 2,500 cumulative 6 per cent. second preference shares was largely over-subscribed.

Charing Cross, West End & City Electricity Supply Co.—A 5 per cent. dividend on the ordinary shares for 1914, as in 1913, is recommended.

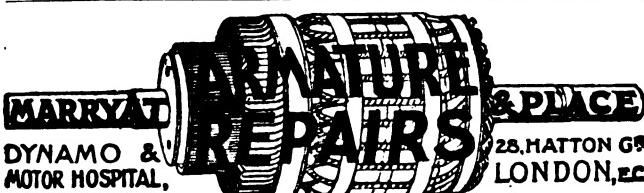
County of London Electric Supply Co.—A dividend of 7 per cent. is declared on the ordinary shares for 1914, the same as in 1913. £40,000 has been placed to depreciation and £10,000 carried forward.

NEW COMPANIES

DERBY LAMP WORKS, 9-10 Pancras Lane, E.C. Capital £85,000 (16,500 profit participating cumulative preference shares of £1 each, and 274,000 ordinary shares of 5s. each). Two directors are to be nominated by the liquidator of Metalite, Ltd.

ELECTRIC LAMP FACTORS.—Registered by Farrar, Porter & Co., 2 Wardrobe Place, Doctors' Commons, E.C.

SOCIETE ANGLO-BELGE D'EXPORTATION, 14 Great Smith Street, Westminster, S.W. Capital £5,000. Merchants and importers and exporters of electrical and other merchandise. The directors include R. W. Blackwell and Philip Dawson.



ELECTRICAL ENGINEERING

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SUMMARY

AN interesting and important action is now being heard before Mr. Justice Warrington in the Chancery Division, in which the Robin Electric Lamp Co., Ltd., is seeking a compulsory licence under Section 24 of the Patents Act of 1907. The object is to manufacture drawn tungsten wire under certain patents owned by the British Thomson-Houston Co. and Messrs. Siemens Bros. Dynamo Works, as it is alleged that these companies have refused to supply the Robin Electric Lamp Co. with wire on reasonable terms (p. 90).

ATTENTION was called by Sir John Snell at the last meeting of the Institution of Electrical Engineers that Mr. C. P. Sparks has a brother and three sons serving at the Front. His youngest son has been mentioned in despatches and awarded the Military Cross (p. 91).

IN a paper read at last Thursday's meeting of the Institution of Electrical Engineers and also at several of the Local Section meetings, Mr. C. P. Sparks gave a detailed description of the electrical equipment of the Powell Duffryn Collieries, South Wales, commenting on a number of matters connected with electricity applied to mining, especially as regards earthing connections, and colliery bell signalling (p. 91).

AT a recent meeting of the Association of Mining Electrical Engineers, Mr. W. Maurice read a paper on colliery electric lamp rooms (p. 93).

IN a recent lecture, Mr. V. Stobie urged that a finer quality of steel could be produced by treating the product of a basic open-hearth furnace in an electric

furnace than direct by the acid open-hearth process at an increased cost of only 1s. 6d. per ton (p. 93).

A PAPER by Mr. J. Bowman, read recently in Scotland, deals with electricity at the coal face (p. 93).

AMONG the subjects of electrical patents of interest to mining electrical engineers published during the past month are electric miners' lamps, prevention of sparking from bells, and the control of winding plants, and two patents relating to electric furnaces (p. 93).

SOME typical examples of mining electric plant are illustrated on pp. 94 and 95.

THE third list of members of the Institution of Electrical Engineers on military service is published, bringing the total to 805. This list, as the second list already issued, includes many men from India and the Colonies (p. 95).

AMONG the specifications published by the Patent Office last Thursday was one for a water heater with interlocked switch and water-tap, and another for rendering the lighting of electric trains independent of fluctuations or interruptions of voltage. A decision has been given that the "Thermit" rail joint welding patents, which are enemy-owned, may be "avoided." Opposition has been entered to two patents for motor control and grid resistances. Patents for intercommunication switches and contacts for radiator lamps expire this week after a full life (p. 96).

THE starting of rotary converters is dealt with in our "Questions and Answers" columns (p. 97).

TWO articles in our Trade Section deal with the use of the Edison battery for electric vehicles (p. 98).

A NEW power station is contemplated at Blackburn; a 1,000 kw. turbo-alternator is required at Dover; a 5,000 kw. set at Hull; new plant at Newcastle-on-Tyne; and an extension scheme estimated to cost £200,000 is to be put in hand at Leeds. General supplies of cable, meters, carbons, etc., are required by a number of authorities (p. 99).

A FIRE at Rotherham last week resulted in the high tension power supply being shut down for a short time.—A large supply for an electro-chemical industry is to be given at Stoke-on-Trent at ½d. per unit.—A scheme for lighting small property on a fixed weekly charge has been devised at Coventry.—The Dublin Electricity Committee has been compelled to raise its charges for lighting by another ¼d. per unit and for power by another ½d. per unit (p. 100).

IT has been decided not to hold the usual Convention of the Incorporated Municipal Electrical Association this year. Two business meetings, however, will be held on June 17th and 18th in London (p. 100).

(For Arrangements for the Week see p. 99.)

Coal Supplies.—A deputation of managers of electricity and gas works in London was received by the President of the Board of Trade yesterday. The Press was not admitted.

DRAWN WIRE LAMP FILAMENTS Compulsory Licence Applied for

THE hearing of an interesting application for a compulsory licence to manufacture drawn-wire filament lamps was commenced before Mr. Justice Warrington in the Chancery Division on Tuesday.

This is the first application for a compulsory licence under Section 24 of the Patents Act of 1907 which has been remitted to the High Courts. The section in question provides for the granting of compulsory licences or in the alternative the revocation of a patent, where it can be proved that the reasonable requirements of the public have not been satisfied by the holders of the patent. This is deemed to have been the case if any existing trade or industry, or the establishment of any new one in the United Kingdom, is unfairly prejudiced owing to the patentee not having manufactured adequately or being unwilling to supply on reasonable terms and conditions.

The present action is at the instance of the Robin Electric Lamp Co., Ltd., against the British Thomson-Houston Co., Ltd., and Siemens Bros. Dynamo Works, Ltd. Counsel engaged in the case are Mr. Bousfield, K.C., Mr. Cave, K.C., and Mr. Frost for the Robin Electric Lamp Co.; the British Thomson-Houston Co. is represented by Mr. A. J. Walter, K.C., Mr. J. Hunter Gray, and Mr. Lunge; whilst Messrs. Siemens Bros. Dynamo Works are represented by Mr. A. H. Colefax, K.C., and Mr. Hume.

In opening the case Mr. Bousfield, K.C., explained that Mr. Robin, the owner of Patent No. 6,856 of 1911, which relates to a double filament incandescent lamp, seeks a compulsory licence under the following nine patents relating to drawn tungsten wire owned by the British Thomson-Houston Co. and Messrs. Siemens Bros. Dynamo Works:—20,277/04, 3,174/07, 19,932/08 (Siemens), 21,513/06, 16,530/07, 23,499/09, 2,759/10, 8,031/10, and 17,722/11 (B.T.-H.). These firms, he added, together with the Osram Lamp Works, Ltd., had pooled all their patents, which were generally admitted to be the fundamental patents, amounting to some 150 or 200, relating to the manufacture of drawn tungsten wire. In July, 1912, Mr. Robin communicated with Messrs. Siemens Bros. Dynamo Works with regard to the manufacture of lamps under his patent. This lamp contains two independent filaments, of the same size, connected to two pairs of contacts in the cap, and by an ingenious arrangement of a ring round the cap (which is of special shape) the lamp can be turned in the holder should one filament break, and is thus given a new life. Messrs. Siemens offered to make the lamps on the understanding that the retail price was one shilling more than the present list prices fixed by the Tungsten Lamp Association for ordinary single filament lamps, of which the three firms mentioned above, and all their licensees, are members. This offer was considered exorbitant, and Mr. Robin decided to undertake the manufacture of his lamp himself. Consequently in December, 1912, the Robin Electric Lamp Co. was formed, and Messrs. Siemens were then asked to quote for supplying 20,000 metres of drawn tungsten wire per month suitable for these lamps. Messrs. Siemens having refused to quote, however, a request was again made for a quotation on reasonable terms or that a licence should be granted, but neither suggestion was acceded to. A similar application was then made to the B.T.-H. Co. after the matter had been placed in the hands of the Robin Electric Lamp Co.'s solicitors. The B.T.-H. Co. offered to supply wire at 12s. per thousand feet for 25- to 100-watt 100-volt filaments, and 15s. per thousand feet for filaments for less than 25- and over 100-watt 100-volt. This was regarded as an extraordinary price, as the Robin Co. had received an offer from a Swiss firm to supply similar wire at 14s. per thousand feet, which was equivalent to ½d. per lamp, whereas the prices quoted by the B.T.-H. Co. would increase the cost of the Robin lamp by 5d. in the case of a single filament lamp or 10d. in the case of the double filament lamp under the Robin patent.

Mr. Bousfield then dealt with the effect on the price of tungsten filament lamps in this country due to the operations of the Tungsten Lamp Association. Lamps identical with those now being sold in this country at from 2s. 6d. to 2s. 9d., he said, were being sold abroad to the public at 10d., and it was clear from what had taken place in the present case and from the differences in the prices in this country and abroad that the sole object of the Tungsten Lamp Association was to force every lamp manufacturer into the ring in order to keep the prices up against the public. Obviously if the owners of the Robin patent obtained a supply of drawn tungsten wire upon reasonable terms, it could be placed upon the market at a price which would very seriously

compete with the lamps sold by the members of the Tungsten Lamp Association, and clearly it was for this reason, he said, that the Robin Co. had been refused either a supply of wire on reasonable terms or a licence to manufacture the wire itself. As to the difference between the price of a single and a double filament lamp, he suggested that 3d. was all that need be added to cover the extra cost of the filament and manufacture, whereas the effect of the terms offered by the B.T.-H. Co. would be to increase the price by 1s.

Passing to a consideration of Section 24 of the Patents Act, Mr. Bousfield contended that the Robin Co. was entitled to a supply of drawn tungsten wire *per se*, and that the owners of the drawn-wire patents had no right to inquire as to the use to which it was to be put. It was clear that the "reasonable requirements of the public" were not being met by the owners of the patents, as they refused to supply anybody outside the Tungsten Lamp Association, except upon prohibitive terms. The refusal to supply the Robin Co. with wire was that the trade of the Robin Co. was "unfairly prejudiced by the conditions attached by the patentee" in the words of Section 24.

Mr. Justice Warrington suggested that the wording of the Act might mean that the reasonable requirements of the public must be met, and not the requirements of any one individual.

Mr. Bousfield referred to Section 5, Sub-section (a), of Clause 24 of the Act, which referred to the establishment of any new trade. The Robin Co.'s business was a new trade, and it would be for the judge to decide what was a fair royalty to be paid.

Mr. Justice Warrington: How am I to do that?

Mr. Bousfield said it could only be arrived at by the consideration of the cost of manufacture of the wire by the patentee, and in the absence of precise information to this effect, which he did not suppose the patentees would give, the judge could only give such a decision as would be a guide in arriving at what would be a fair royalty.

Evidence for the Robin Lamp Co. occupied the whole of Tuesday and part of yesterday. Mr. C. D. Falcke, the secretary, and Mr. Robin, the patentee, said that they desired to obtain the wire or even to have the lamps made for them in this country if they possibly could, but they would manufacture both the filament and the lamp if they could not be obtained from other manufacturers at a reasonable price, or import the lamps and pay a royalty. Quotations had been obtained elsewhere for the supply of wire, all much lower than the B.T.-H. price. Duram, Ltd., had quoted 38s. 7d. per 1,000 ft., a Stockholm firm 29s. 9d., a French firm 43s. 2d., and two German firms 37s. 4d. and 12s. 9d. respectively, the last price being for very large quantities. The Robin Co. had also had sample double filament lamps with squirmed filaments made by Cryselco, Ltd., in 200 lots at 1s. 4d. each lamp for low voltage, and 1s. 6d. for high voltage, and Messrs. Siemens had made some 105-volt tantalum at 1s. 6d. The manufacturers of the Serena lamp had offered low-voltage double filament lamps at 6d., and high-voltage at 9d. up to 50 c.p. Mr. Robin said that his own personal opinion was that a reasonable retail price would be about 3d. above the prices fixed by the Tungsten Lamp Association for single filament lamps. The capital of the Robin Co. is £25,000; 10s. per share has been called up on 10,350 £1 shares, and the actual cash balance available at the moment is about £2,000.

Mr. Falcke referred to an estimate of £25,000 for a lamp factory for turning out 2,000,000 lamps per annum, whilst Mr. Robin said he had been offered a complete plant in Paris for the manufacture of drawn tungsten wire at £2,000, the capacity being 5,000,000 metres per annum. It was suggested in cross-examination that this plant was the property of a manufacturer who was being proceeded against for infringement, and that the estimate for the complete lamp factory was hopelessly low.

Evidence was also given by Mr. S. Biheller, an importer of lamps and component parts from abroad. He said he could buy wire for low-voltage lamps at 6s. per 100 metres, glass bulbs at 33s. per thousand, and glass supports at 4d. per lamp, the caps at 20s. per thousand, and adding the cost of the leading-in wires, &c., the total cost for labour and material came out to something under 4d. per lamp. He could buy lamps similar to those quoted at 2s. 2d. in the Association's list at 6d. for re-sale abroad, and those quoted at 2s. 8d. for 9d. or 10d. The standard retail price in Germany for the lamp listed here at 2s. 2d. was 1s. 1½d., and in Canada 1s. 8d., and Australia 1s.; and for that listed at 2s. 8d. it was 1s. 9d. in Germany. Mr. Walter, in cross-examination, reminded witness that his figure of 4d. as the cost of a lamp did not include overhead charges, selling charges, advertisements, management, rent, rates, interest on capital, &c., and that the wire which he spoke of as buying at 4s. 6d. included nothing for royalty either in the country of origin or in this country.

Mr. T. Rose, of Rose Bros., Electrical Engineers, said that in Holland a single filament low-voltage lamp could be bought at 6d. wholesale, and a high-voltage lamp at 8d., the retail prices being 1s. and 1s. 3d.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

ELECTRICITY APPLIED TO MINING

A LONG and comprehensive paper with this title, by Mr. C. P. Sparks, was read at last Thursday's London meeting of the Institution of Electrical Engineers. It also formed the subject of discussion on Tuesday and Wednesday at the Western and Manchester Local Sections, and will be discussed at Birmingham on Wednesday next.

At the London meeting the President (Sir John Snell) said that before calling on Mr. Sparks to read his Paper he wished to refer to a personal matter, because he was sure they would all wish to join in offering congratulations to Mr. and Mrs. Sparks. Not only had Mr. Sparks a brother who took such an honourable part in the London Scottish charge in Flanders, and who had come back wounded—but who, he was glad to say, was now convalescent, and was looking forward to returning—but three of his four sons were serving their King. One was in the Royal Engineers, another was in the Artillery, and the youngest, a youngster of only 18½, who had so done his duty at the front that he had not only been mentioned in despatches, but had been awarded the Military Cross by His Majesty. He (Sir John) had only one son, and he was serving his King to the best of his ability, and he would be indeed proud of him if he could mention such a record. He was sure it must be of the greatest legitimate pride to Mr. Sparks and his wife to feel that their sons were doing such splendid work, and showing such a splendid example to the young men of this country.

Mr. Sparks said it was very difficult to find words to express the gratitude of his wife and himself for what Sir John Snell had said, and the way the members had received it. He was indeed proud of his three sons, who with so many hundreds of Englishmen were doing their duty, and he was specially proud of the young fellow who had been awarded the Military Cross.

The paper dealt principally with the electrical installation at the Powell Duffryn Collieries, South Wales, a concern raising coal at the rate of 4 million tons per annum, working over an area of 16,000 acres, and comprising 9 collieries in the Aberdare Valley and six in the Rhymney Valley. The electrical plant for the whole group aggregates 24,000 kw., with an estimated output for the present year of 62 million units. One colliery, the Britannia, is worked entirely electrically. Transmission in the Aberdare Valley is three-phase at 3,000 volts, in the Rhymney Valley at 10,000 volts, and from Aberdare to Rhymney at 20,000 volts. The frequency of 50 cycles was chosen in preference to 25, for reasons among which were the more convenient speed of the generators and greater possibility of speed variation on the motors. Discussing the relative merits of power supply from a company or separate generation, the author pointed out that the introduction of exhaust steam turbines and the possibilities of utilisation of coke-oven gas for power purposes had increased the field for the latter. In some cases joint working was advantageous. In any case, some spare plant at the collieries was desirable, and the Powell Duffryn Co. had met this by erecting as stand-by plant certain reciprocating engines displaced by more modern plant.

The scheme includes the following four generating stations :—Middle Duffryn (in the Aberaman Valley), with one 5,000-kw. and three 2,000-kw. high-pressure turbo-alternators; Penallta, with two mixed-pressure 3,000-kw. turbo-alternators; Bargoed, with two 1,600-kw. and one 800-kw. gas engine-driven sets, and a 2,000-kw. mixed-pressure turbo-alternator; and Elliot Pit, with two 500-kw. exhaust steam turbo-alternators. The last three are in the Rhymney Valley. In all cases, except Penallta, river water is available, but here the only source of circulating water is the pit. Exhaust steam (derived from existing steam winding engines and air-compressor engines) is used at three stations. The Rateau heat accumulator system is employed at Elliot and Penallta, but the Samuelson system, which employs a steam accumulator of the gasometer type, is used at Bargoed. It is

found that whereas the Rateau plant gives a back pressure of $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. per sq. in., with the Samuelson system it never exceeds 0·5 lb. The mixed-pressure plant at Bargoed works in parallel with the gas-driven plant with a success that speaks well for the speed regulation of the plant under the changing steam conditions. Some particulars of the gas-engine plant and other details of the Bargoed and Penallta stations have already been given in ELECTRICAL ENGINEERING, Nov. 2nd, 1911, Mining Supplement, p. lxvii. Taking the whole scheme, about 14 million units are generated by coke-oven gas, about 14·5 million by exhaust steam, and 21·5 million by live steam. The load factor of the gas plant is kept high by putting it into the electric pumping plant load at night, and the average figure is 72 per cent. against 47 per cent. for the live steam plant.

The transmission lines are all bare copper lines on wooden poles. The 3,000-volt system in the Aberdare Valley is arranged as a ring main with Merz-Price protection, the pilot wires being in the form of three-core lead-covered cables slung from galvanised steel catenary wires. The 10,000-volt lines in the Rhymney Valley, $3\frac{1}{2}$ miles long from Bargoed to Penallta, is arranged so that the Britannia Colliery near the centre of the line can be supplied from either of the two power houses by two sets of duplicate transmission lines. From Bargoed to the new Tredegar and Elliot pits the line is worked at 3,000 volts, but ultimately the pressure will be increased to 10,000 volts. A connecting link between the Aberdare and Rhymney systems is to be made by a 20,000-volt line from the Middle Duffryn power house and the Britannia Colliery (9 miles), but by changing the transformer from mesh-star to mesh-mesh and cutting out a part of the neutral ends of the star winding, the pressure will ultimately be raised to 30,000 volts. This line will be on steel poles with a copper earth wire. The distribution underground has always been by multicore armoured cables, with the armouring earthed. In the case of important pumping plant, duplicate cables are used either on opposite sides of the shaft or where possible in separate shafts.

The author discusses the question of earthing connections in some detail, recapitulating the Home Office regulations and recommendations, and gives the results of some experiments on the subject. In general, earth connections made strictly on the official lines gave resistances too high to be satisfactory except where the conditions are very favourable, and in one case an earth connection of this character was such that had it been called upon to carry 500 amperes for a short period to enable a circuit-breaker to open, a potential of at least 500 volts above earth would have been produced. The contact area of the coke bed should, in his opinion, be materially greater than is specified in the Regulations, but compared with this the use of the metal plate was unimportant. His tests also show the desirability of burying the earth plates at considerable depth to avoid too great a potential gradient on the surface. With regard to earthing the neutral point of a three-phase system, the author is strongly of opinion that this should be made compulsory.

The switchgear in the Company's generating stations is described in the Paper. It follows the best standard up-to-date practice with its sectionalised ring bus-bars. The generators are protected by time-limit overload and reverse current relays, the feeders by time-limit overload, and the transmission lines by time-limit overload relays and the Merz-Price system. Extensive use is made in the newer stations of switch pillars on the floor level, carrying the operating gear for the oil switches in the cells below and the necessary instruments. Tirrill regulators are used to maintain constancy of voltage. The power factor varies from 0·7 to 0·85. The generators are rated to give their full output at 0·75, and, owing to the moderate distance of transmission, there has been no difficulty in maintaining the normal pressure at the individual collieries, but to deal with further extensions some of the larger motors will probably be fitted with power factor correctors.

One of the most interesting features of the whole installation is the pair of electric winders supplied by Siemens

Brothers Dynamo Works, Ltd., at the Britannia pit, with flywheel power storage on the Ilgner system. Each of these is designed to handle 390 tons of coal per hour from a depth of 730 yards. Two 30-ton flywheels are used on the converter set, and each winder is direct driven by two motors working up to 4,300 h.p. A full illustrated description of this plant was given in ELECTRICAL ENGINEERING in the article already referred to. During sinking each winder was worked with one motor and a parallel drum, but a cylindro-conical drum will replace these. An electric winder driven by a direct-coupled induction motor is in use at the Abercwmboi Colliery. The motor, of a normal rating of 375 h.p., works up to a maximum of 700 B.H.P. This winder was described in detail in ELECTRICAL ENGINEERING, Sept. 1st, 1910 (Vol. VI.), Mining Supplement, p. xciii.

A large number of electrically-driven pumps are used in the various collieries, many of which displace older steam pumps. All the large pumps are of the direct-coupled multi-stage type. The largest pumping station, at the Elliot Pit, contains, besides two other pumps, a six-stage Sulzer pump driven by a 1,000-h.p. slip-ring motor built into a turbo-alternator frame and provided with forced ventilation by electrically-driven fans drawing air through special filters. Most of the principal main ventilating fans are driven by induction motors by a rope drive allowing of the speed to be altered to meet change of requirements by altering the pulley ratio. A stand-by motor is usually provided. The fan at the new Britannia Colliery, in which a gradual alteration of speed is required to keep pace with the development of the colliery, is driven by an 850-h.p. continuous-current motor supplied through a rotary converter. The same system of drive is also used in the case of one of the air compressors at the same colliery, which is required to run at varying speed, but most of the compressors on the system are driven by constant-speed induction motors. With regard to electrical haulages, the author remarks generally that owing to the intermittent nature of the load, the high torque necessary for starting and the tendency for all haulages to be used together at the end of a shift, this kind of load is one of the most costly to supply unless a large number of haulages are worked from the same power house. Typical single and double reduction haulages are described in the Paper. The original controllers were of the oil-immersed drum type with metallic resistances, which were not only costly but occupied considerable space. Where water is available all the larger controllers are now of the liquid type, which is preferred on account of its simplicity and the finer speed adjustment obtainable.

The underground fixed lighting is confined to the immediate pit bottoms and the haulage and pump rooms. It is carried out at 110 volts by carbon filament lamps. Extensive use is made of electric miners' safety lamps, of which the Company have already between seven and eight thousand in use. It is found that the miners welcome their use in spite of the extra weight ($5\frac{1}{2}$ lb. against $3\frac{1}{2}$ lb. for flame lamps) on account of the greater illumination. Experience with these lamps shows that the energy required for charging is of minor importance, and the cost of attendance for charging and cleaning the electric lamps is comparable with the cost of the daily attention necessary in the case of ordinary oil lamps. The cost in the case of the lead battery of lamp renewals about equals the cost of battery maintenance. Two types of battery are used. With the original lead type the positive plates lasted about nine months; new positive plates were then inserted to run a further nine months, before the negative plates required renewal. Improved positive plates are now on trial, and it is hoped that they will last eighteen months. The alkaline type of battery is also under trial. Although these are twice as expensive as the lead type, their life is very much longer. In addition to the miners' lamp, a second type is being tried for officials and hauliers, with the battery strapped to the man's back and the lamp fixed in his cap.

The concluding part of the Paper dealt with haulage signalling by electric bells, a system which has been in use for about twenty-five years, although its safety has only been questioned during the last two years. Indeed, when the last Regulations were drawn up, little was known as to the degree of danger from ignition of gas due to open sparking from this cause. The author gives particulars of the experiments made by Home Office officials after the Senghenydd accident, at which he represented the colliery owners, and the subsequent experiments of Dr. Wheeler. Subsequent experiments at Faraday House are also referred to, showing the effect of inductance on the actual voltage developed at the break, which reached 180 volts in one case with only

nine cells in circuit. These records show the necessity of considering the inductance of the circuit before specifying the safety limit in terms of volts and amperes. The author suggests the following system for ensuring safety over moderate distances:—Bare galvanised wires of No. 8 S.W.G. should be run high up on insulators on opposite sides of the roadway. Bells to have the contact-maker completely enclosed in a metal flame-tight cover, the contact being shunted by a resistance or a condenser, the shunt being inside the bell case. The number of dry cells to be limited to 10, the batteries being sub-divided into two groups, one half being placed at either end of the line. The batteries to be kept in locked boxes of only sufficient size to hold the standard number of cells, so that they must be replaced when run down instead of an indefinite number being added. Signals to be made by switches actuated by a "pull" wire, the switches being enclosed in rigid metal, the covers being flame-tight, and the switch contacts breaking contact through non-inductive resistances contained in the same metal case as the switch. For long-distance signalling a high-resistance relay with a shunted contact and enclosed in a flame-tight, rigid, metal case should be used, the shunt resistance being inside the relay case. Where this is done the line pressure can be kept down to six volts. Alternatively the alternating-current system could be adopted. This has the advantage of getting rid of battery maintenance. The transformer pressure should be 15 volts, and the bells should have their coils enclosed in rigid metal.

The discussion in London was opened by Mr. C. H. Merz. Speaking of exhaust steam turbines, he said that he looked upon them only as a temporary expedient. Future developments would be in the direction of greater thermo-dynamic efficiencies. At present in comparatively small units, the gas engine was much more efficient, but in the larger units, the steam turbine scored.

Mr. S. Evershed, dealing with the question of sparking from bell circuits, pointed out that the factor that made for safety or danger was not the voltage but the electromagnetic energy stored in the circuit to be broken. The temperature of the spark was governed by the rate at which the induction decreased. If the spark were blown out by a magnetic blow-out the spark was made all the worse from their point of view. If there was sufficient energy and the electrodes were capable of being volatilised, a flash was obtained in addition to the spark, and the vapourised metal shot off. He believed that it was comparatively easy to devise a condenser system which would suppress the spark in a bell, but nevertheless the problem should be taken up of producing a bell in which there was absolutely no spark. The sparking made when the bell circuit was closed in the roadways was a greater difficulty than the bell itself. In a bell, platinum was used, and if care were taken that no other metal was near, there was nothing to vapourise, but in the colliery wires they used the worst material possible. There would be far less sparking with copper wires or copper-coated steel wires. He was not himself convinced that the Senghenydd disaster was due to the bell circuit, but felt that it was necessary to make the application of electricity in mines so safe that colliery owners need not fear to put in a little bell.

Mr. W. J. Larke, referring to Mr. Spark's strong plea for the earthed neutral, expressed the hope that he would go further and use his influence to ensure that the Home Office will make the earthed neutral compulsory. The argument on the part of colliery people was that with an unearthing system it is possible to continue working with a fault on the system, but this he regarded as the very reason why the earthed neutral should be insisted upon. With regard to the larger motors, he was of the opinion that the power factor corrector had not yet been properly considered in relation to the enormous financial advantage obtainable by its use. He also referred to the Ralph gas detector, which he said showed remarkable accuracy over a range of from $\frac{1}{2}$ to 3 per cent. of moisture.

Mr. W. R. Cooper asked for some further information as to the earth plate test, and

Mr. J. W. Holliday, who carried out the earth-plate tests for Mr. Sparks, said experiments had been made upon the resistance of various soils, and that of damp brown London clay was less than any other. It was approximately 40 ohms per foot cube. London tap water had a resistance of approximately 100 ohms per foot cube, and distilled water 1,500 ohms, all at 50° F. The addition of 0.008 per cent. of common salt by weight to the distilled water caused the resistance to fall to 175. This was equivalent to half an ounce of salt to a barrel of water. The principal factor in the resistance of the various soils was not so much the presence of water, but the traces of soluble salt, which lowered the resistance enormously.

Mr. A. Rushton spoke of the possibilities of economy in electric winding if several collieries combined for purposes of power supply, when the magnitude of the system would make the expense of load equalising apparatus unnecessary.

Mr. Sparks replied briefly.

COLLIERY ELECTRIC LAMP ROOMS

A PAPER by Mr. W. Maurice, read recently before the North Staffordshire Branch of the Association of Mining Electrical Engineers, dealt with the design and equipment of colliery electric lamp rooms. When the number of lamps did not exceed 200 to 300, existing lamp rooms could usually be adapted. Up to 200 lamps he recommended the wall type, and for more than that, the floor type of rack, and he favoured the Continental pattern in which the lamps are suspended on hooks instead of resting on shelves, as was usual for British flame lamps. The charging stands for the cells should be arranged so that when placed on the insulated shelves the cell terminals come automatically in contact with current-carrying strips immediately above them. Every charging board must be provided with voltmeter, ammeter, reverse current, cut-out, switches, fuses, and regulating resistances. He recommended that the charging voltage should not exceed 110 watts, which would charge 40 lead cells or 26 groups of two Wolf alkaline cells. The work benches required are generally similar to those used for flame lamps. Troughs with an adequate supply of water are necessary for the washing out of cells, &c., and a simple conveyor system which serves to transport the cells from one end of the room to the other is desirable. The cells can be placed in wheeled trays holding 20 each for this purpose. Lamp unlocking machines can be mounted at the ends of the benches, and small motor-driven cleaning machines with revolving brushes are required. The unlocking machines should be of massive construction, and are preferably worked by foot switches to keep both hands free. Electric lamp rooms should be more spacious than those used for flame lamps, and since no warmth is derived from the lamps, require to be heated. A supply of distilled water is essential. This may be obtained from small electrically-heated distillers. Every lamp room should have as an annexe a mechanical repair shop and a store room with lock-up cupboards for bulbs and other spares. Space is also sometimes required for a motor-generator and switchgear. Several typical electric lamp rooms were described in the Paper.

ELECTRIC STEEL

A T a lecture given recently before the Cleveland Institution of Engineers at Middlesbrough, Mr. V. Stobie gave a lecture on the manufacture of steel in the electric furnace. Steel made in the electric furnace, he said, had the following advantages over other steels:—(1) Regularity of composition; (2) lowering of sulphur and phosphorus; (3) absence of gases; (4) higher yield of sound ingots; (5) positive control of furnace operations. He had found that the electric steel furnace of his own design in combination with a basic open-hearth furnace would produce steels higher in quality than acid open-hearth steel at a lower cost. Molten steel of a very ordinary quality from a basic open-hearth furnace, treated in an electric furnace, would be equal in composition to acid steel made from the finest Swedish material; would be sounder; would give a greater yield from the ingot; whilst the cost price would not be increased by more than 9s. 6d. per ton. If the extra yield represented a 10 per cent. improvement on some existing practice, the saving might be taken as equivalent to 8s. per ton. This deducted from the extra cost gave a net extra cost of 1s. 6d. per ton. It was for the higher grades of steel that the electric steel furnace was brought into existence.

ELECTRICITY AT THE COAL FACE

A PAPER by Mr. J. Bowman with the above title was read at a recent joint meeting of the Scottish Branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers. Dealing with electric coal-cutters, the author said that the principal difficulties were due to the limited dimensions under which motors and controllers had to be constructed, especially those for use in thin seams. Trouble was generally caused in A.C. machines by the smallness of the air-gap, the burning out or breaking of resistances, the burning of contacts when the cutting wheel becomes jammed, and by the development of faults which were difficult to locate. Excessive heating of the windings when the material was difficult to cut was also liable to give trouble, and another cause was the lack of knowledge by those who are responsible for keeping the machines in good order. A simple fault might occur that involved stripping part of the winding. This must be done on the surface, and in the event of no spares being at hand that section of the mine

may be idle. Another source of trouble was the trailing cable. There was difficulty in providing an efficient earth connection from the machine to the main cable and keeping it in that condition. More than once the author had seen the earth core broken without the fault being visible, and although this could be got over by using an equivalent sectional area of copper as an outer spiral armouring to the cable, in addition to the earth core in the interior, the method added considerably to first cost. In electrical heading and boring machines the motors were often not constructed of sufficient size to be efficient. The use of such a machine was to a certain extent limited, but a light portable electric machine capable of boring shot-holes in coal would be a valuable asset in many collieries.

Electricity might be applied to all types of conveyors at present on the market, but with especial ease to all those conveyors which continuously move in one direction. The advantages of electric self-contained haulage gears were also touched upon, and with regard to dock-face pumping the ideal equipment would be a compact, direct-driven turbopump on a bogie; the solid matter found in the water sometimes precluded its use. In many cases where there were difficulties in ventilating the face a small electrically-driven fan would give excellent results. There were sometimes cases where compressed-air apparatus might be preferred, and this could be worked most advantageously by local electrically-driven air compressors.

MINING AND METALLURGICAL PATENTS OF FEBRUARY

Mining.

IMPROVEMENTS of detail in the construction of electric miners' lamps are described in Specification No. 2,063 of 1914 by J. F. Turquand. These relate chiefly to the construction of a gas-tight switch, and the arrangement of packing to render the joint of the outer glass gas-tight. An interesting patent, in view of the investigations recently made on the danger of ignition from colliery bells, is No. 2,808 of 1914, in which Dr. W. M. Thornton protects the application of a non-inductive resistance in parallel with the magnet coils of a bell to diminish sparking at the trembler contact to such an extent that ignition of gas cannot take place. Another specification relating to electrical engineering in mines is No. 6,351 of 1914 of the B.T.-H. Co. and E. I. David for mechanical arrangements in the control of electric winding gears. The depth indicator and operating lever are interlocked by means of a drum carrying guides, so that the movement of the liner is limited at starting, and it is automatically brought back to the "off" position at the end of the wind.

Metallurgical.

A specification (No. 15,456 of 1914) by F. J. Machalske describes furnace electrodes of the block type, consisting of a carbon rod or rods enveloped by a refractory magnesium basic slag, producing material of relatively low resistance when heated. Another patent relating to electric furnaces is one by J. L. Dixon (No. 4,742 of 1914), which covers a number of arrangements of connection of arc furnaces in which the current flowing through an electrode in the body of the furnace is adjustable relatively to the current in the main carbon electrodes. One such arrangement is the connection of the lower electrode to the star point of a three-phase system, with the carbons connected to the three phases. Eight different arrangements, some for two-phase and some for three-phase supply, are described.

An Unusual Accident.—An electric blasting accident of a peculiar nature which occurred recently on one of the Rand mines is reported in the *Iron and Coal Trades' Review*. A round of holes which had just been connected up for firing exploded suddenly, causing four deaths and several injuries. The explosion is attributed to lightning striking the ropes of the skip or the guide ropes, and that these acted as a conductor, connecting with the cable or the wires at the bottom of the shaft.

West of Scotland Branch of the Association of Mining Electrical Engineers.—At a recent meeting of this Branch at Glasgow, Mr. A. Smellie read a Paper on "Experiences in the Handling of Electricity," in which he described the electrical equipment of the New Cummock Collieries in Ayrshire. He urged the necessity of machinery of the best quality obtainable to ensure reliability and reduce maintenance costs to a minimum, and showed how the change from steam to electric driving in a colliery could be made gradually, and the men trained to the new conditions and the conversion proceeded.

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ELECTRICAL MINING PLANT

MINING electrical engineers will welcome one of the most recent and, we may say, one of the best-prepared pieces of technical literature that has been produced by the General Electric Co., Ltd. (67 Queen Victoria Street,

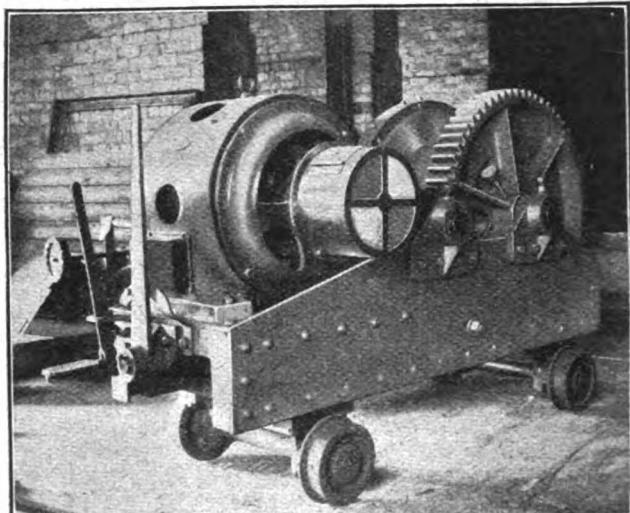


FIG. 1.—50-H.P. PORTABLE HAULAGE GEAR.

E.C.), in the shape of Part I. of the G.E.C. Bulletin on colliery and mining machinery. This is a work of over 180 pages full of engineering information regarding electrical mining plant, incidentally illustrating a large number of

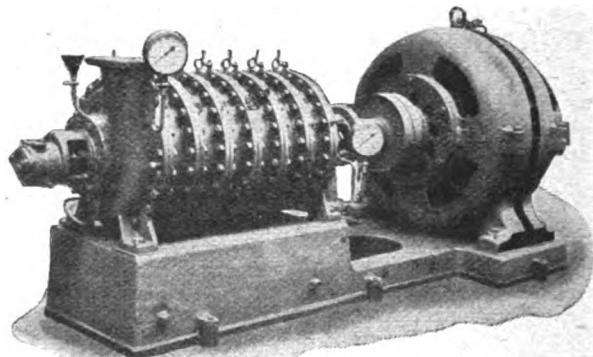


FIG. 2.—80-H.P. WITTON MOTOR DRIVING SIX-STAGE CENTRIFUGAL PUMP.

examples of machinery and apparatus supplied by the Company, and putting forth data of considerable utility to those engaged in the selection of colliery equipment. The title of the first section, "General Considerations concerning the

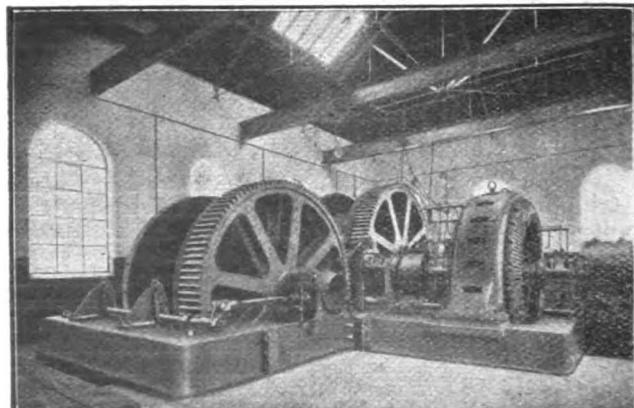


FIG. 3.—400-H.P. HAULAGE GEAR AT BRANCEPETH COLLIERY.

"Selection, Installation, Connecting-up, and Arrangement of Generating and Transforming Plant for Collieries," aptly describes its range, but particular attention should be called to the useful series of diagrams of transformer connections.

The general lay-out of power houses and sub-stations is then considered, and views and plans of typical generating stations equipped with "Witton" plant are reproduced. The following section treats of motor-driven fans, air compressors, and other appliances. The whole subject of motors for mining work is dealt with, and the special explosion-proof motors made by the Company are illustrated and the many good points in their design explained. Particular attention has been paid not only to the flame-proof nature of the motor, but to the way in which the cables are taken to the motors

of the products in this direction have been illustrated in ELECTRICAL ENGINEERING. The most important points of their designs on this class of work are detailed in a section on colliery switchgear and relays, which is very comprehensive. In this are included special instruments, such as a new gas detector, and protective apparatus of a variety of types, including the Moscicki condenser and Giles valve systems. Much practical information on colliery cables occupies another section, with a few details as to transmission lines. Other subjects treated are mining telephones

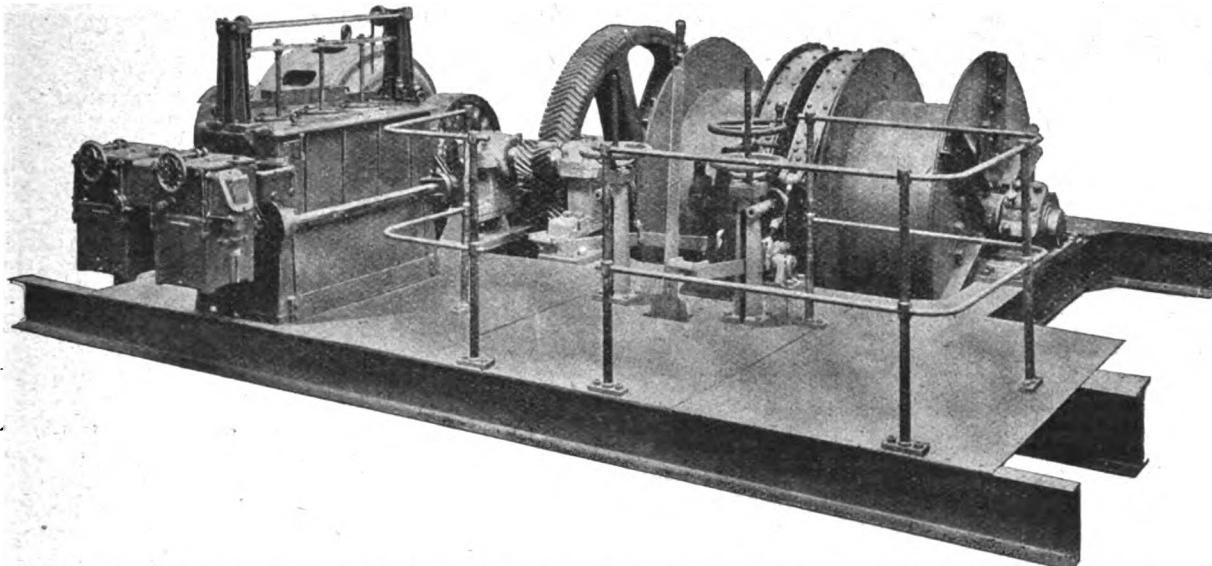


FIG. 4.—140-H.P. MAIN AND TAIL HAULAGE GEAR WITH OIL-IMMERSED CONTROLLER AT WALESWOOD COLLIERY.

and the bringing out of the stator connections. A convenient portable haulage gear driven by a Witton induction motor is shown in Fig. 1, and another Witton motor is seen driving a centrifugal pump in Fig. 2. The section devoted to winding plants is particularly interesting, and contains a description of the Ilgner system of flywheel storage and other methods of control. An example of a main-and-tail haulage gear, showing the control apparatus, is shown in Fig. 4. The Company have for long paid special attention to mining switchgear, and from time to time a number of examples

and colliery lighting. The whole work reflects great credit on its compilers, and is an evidence of the thoroughness with which the General Electric Co. have gone into the many special problems arising out of the applications of electricity to mining work. It will be remembered that Part II. of the G.E.C. Colliery Bulletin, which partakes more of the nature of a catalogue of the Company's electrical mining plant and appliances and dealt in greater detail with mine signalling apparatus, has already made its appearance, and was reviewed in ELECTRICAL ENGINEERING, Jan. 7th, p. 5.

ELECTRICAL MEN ON MILITARY SERVICE

THE third list of members of the Institution of Electrical Engineers on military service has just been issued, and includes 72 names, bringing the total to 805. The first list was published in our issue of Jan. 21st, and the second list on Feb. 18th. We give the third list in full below:—

MEMBERS.

W. Bridges (Major, R.F.A.), W. F. Long (Capt., Cape Fortress Engineers, R.E.), J. C. M. Matthews (Corpl., Malay States Volunteer Rifles), H. L. Percy (Lieut., Ceylon Engineer Volunteers), F. Pickering (Major, Cape Fortress Engineers, R.E.), R. E. P. Pigott, C.I.E. (Major, 12th Essex Regt.), C. T. Williams (Capt., Northern Signal Service, R.E.)

ASSOCIATE MEMBERS.

W. Baker (Sergt., Cape Garrison Artillery), L. C. F. Bellamy, C. Bollam (Lieut.), J. M. M. Booth (2nd Corpl.), J. M. Brewis (Lieut.), I. C. Brown (Southern Provinces Mounted Rifles), E. A. Corbin (Malay States Volunteer Rifles), V. K. Cornish (Chief Electrician, Lines of Communication, Suez), J. Cunningham (Staff Sergt., Bombay Volunteer Artillery), I. S. Dagleish, C. H. W. Edmonds (Lieut.), S. G. L. Eustace (Calcutta Light Horse), T. I. M. Gordon (Penang Volunteers), N. Harrison (Major, Union of South Africa Defence Force), H. W. Henderson (Calcutta Port Defence Volunteers), A. I. Hodgson (2nd Lieut., Hyderabad Volunteer Rifles), W. J. Horne (Capt., Union of South Africa Defence Force), J. W. Houghton (Canadian Engineers), J. A. W. Kerr (Capt., Transvaal Scottish), D. Kerridge (Bengal Nagpur Volunteer Rifles), D. S. Laurie (2nd Lieut.), W. R. Macdonald (Lieut., Canadian Naval Service), W. D. MacGregor (Capt., Bangalore Rifle Volunteers), H. C. Osborne (Bombay Volunteer Artillery), A. M. Peddie (Imperial Light Horse), J. A. Rutherford (2nd Lieut.), R. Sawers, Junr. (2nd Lieut.), J. H. Shannon (Sub-Lieut.), W. S. Sholl (Algoa Rifle Corps), A. F. H. S. Simpson (Capt., Caucasian Cavalry Division, Russian Army), H. R. Speyer (Lieut., Cossi-

pore Artillery), G. Sykes (Warrant Officer, Admiralty Inspector of Aeroplanes and Seaplanes), H. C. Symmes (Capt., Witwatersrand Rifles), W. I. Tarleton (Sergt.-Major, Cape Fortress Engineers, R.E.), Capt. A. C. Trench (R.E.), Capt. C. E. Vines (R.A.), T. H. Vitty (Capt.), W. G. Ward (Capt.), D. B. Webbe (B. B. & C. I. Rly. Volunteers), S. Webster (Rangoon Port Defence Volunteers), J. W. Wyles (Corpl., Bombay Harbour Defence, R.E.).

ASSOCIATES.

A. L. Annison (2nd Corpl.), W. Bell (Lieut., Mussoorie Volunteer Rifles), H. H. J. W. Drummond (Col., 2nd South-Western Reserve Mounted Brigade), A. R. Walmsley (2nd Lieut.).

GRADUATES.

J. R. Danson (Sergt.), E. F. Hollands (Motor Cyclist, Union of South Africa Defence Force), W. R. Lewis (2nd Lieut., South African Ambulance), J. A. Lloyd (Sub-Lieut.), J. Morgan, H. Morris (Cullinan's Horse), N. B. B. Patel (Poona Volunteer Rifle Corps), C. W. Pearce, G. H. N. Reay (Lieut.).

STUDENTS.

S. J. W. Baldwin (Petty Officer, Royal Naval Air Service), C. H. Brazel (2nd Lieut.), A. S. Bruce, T. S. Brunton (Bombay Volunteer Artillery), D. Mathieson (Singapore R.E. Volunteers), H. P. Organ (2nd Lieut.), J. J. Page (2nd Lieut.), E. J. Symons, H. R. Tuppen (Lieut.), B. P. K. Walsh (Cape Fortress Engineers, R.E.), C. Young (Air Mechanic, Royal Flying Corps).

The Finsbury Magazine.—The magazine of the Old Students Association of Finsbury Technical College contains an excellent portrait of Mr. J. E. Raworth, President of the Association. In addition to a quantity of information as to the doings of past and present students, the last issue contains a contribution by Mr. J. K. Catterson-Smith on Phase-advancers, a description of the Humphry gas pump, and a most interesting account of the mobilisation of the London Electrical Engineers just before war was declared.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Feb. 25th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,327/14. Train Lighting. H. LEITNER. Improvements in variable-speed dynamos for train and car lighting, consisting in the provision of a series field winding adapted to superimpose upon the normal regulation for speed purposes an additional regulation compensating for load and limiting the output with rise of voltage. (Four figures.)

2,605/14. Water Heating. A. F. BERRY. An electric water heater of the type in which the water is heated as it issues from a tap. The switch controlling the heating elements is arranged so that it pushes the tap open when the current is put on, and progressively cuts in more powerful elements as it opens the tap wider. The tap can, however, at all times be opened to a greater extent than that corresponding to the position of the switch, and when fully open the switch can be turned in the opposite direction to cut in a specially powerful element. (Three figures.)

3,696/14. Fuses. E. O. SCHWEITZER, N. J. CONRAD and SCHWEIZER & CONRAD INC. (*Chicago*). A high-tension fuse with a short fusible wire enclosed in a tube full of liquid arranged with a spring pulling the terminals apart when the wire fuses to increase the length of break, and at the same time, by the movement of a funnel-shaped plunger, to direct the liquid against the arc. (Seven figures.) This fuse was described in ELECTRICAL ENGINEERING, Vol. X., p. 565, Oct. 29th, 1914.

4,813/14. Electric Train Lighting. B.T.-H. Co. (*G.E. Co., U.S.A.*). A system of lighting electric trains in which variation of the lights due to variation of voltage and extinction due to temporary interruption of the supply is prevented by the use of a machine coupled to a flywheel which normally runs as a motor, storing energy, but on a drop of voltage acts as a generator to supply the lights. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: DOULTON and MORRIS [Cable troughs] 2,871/14.

Dynamos, Motors, and Transformers: CUMONT [Motor control] 515/14; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Control system for motors supplied with pulsating current] 2,959/14; B.T.-H. Co. and WHITAKER [Current collectors for dynamos] 3,596/14.

Electrometallurgy and Electrochemistry: LEVIN [Electrolytic apparatus] 3,654/14; Soc. GÉNÉRALE DES NITRURES [Fixation of nitrogen] 22,586/14.

Heating and Cooking: HIRST and ARCHER [Electric heating apparatus] 4,432/14; FOSTER, ARUNDALE and DAVIS [Stove] 9,794/14.

Ignition: TEAGUE [Magneton] 25,855/13 and 21,590/14.

Switchgear, Fuses, and Fittings: B.T.-H. Co., YOUNG and GARTON [Motor starters] 3,385/14; SCRUBB [Thermal switches] 18,418/14.

Telephony and Telegraphy: AUTOMATIC TELEPHONE MANUFACTURING Co. and RAY [Telephone system] 2,270/14; AUTOMATIC TELEPHONE MANUFACTURING Co. and SAVIN [Telephone systems] 3,195/14; MARKS (*Electrical Experiment Co.*) [Telephone receivers] 9,638/14.

Traction: DEAN [Switches for automobiles] 3,706/14; ROYDHOUSE and CHEESEMAN [Power transmission, starting and lighting system] 3,925/14; CLARKE [Audible signal repeaters] 9,504/14.

Miscellaneous: TURNER [Control of lighting by selenium cells] 7,440/14; ROBERTSON and BOWMAN [Mine signalling] 9,201/14; HARLÉ ET CIE. [Distant control] 17,567/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distributing Systems, &c.: PETERS [Limiting reactance coils] 23,359/14.

Dynamos, Motors, &c.: NOLAN [Cooling motors] 24,496/14.

Heating: MAJESTIC ELECTRIC DEVELOPMENT Co. [Radiator] 1,740/15.

Telegraphy: SIGNAL GES. [Sending device for subaqueous telegraphy] 1,857/15.

Miscellaneous: "VULKAN" MASCHINENFABRIKS A.G. [Electrically controlled feed mechanism] 1,284/15; FARNSWORTH & ANR., 1,869/15; STILLE [Electro-optical cells] 1,973/15.

Applications for Suspension of Patents

10,859/01 and 24,439/02. **Alumino-thermic Welding.** H. GOLDSCHMID (Essen, Germany). The Board of Trade has decided, upon the application of W. L. Turner and H. A. Blackwell, that these patents, which cover the well-known process of "Thermit" welding more particularly as applied to tramway railjoint welding, be "avoided."

Amendments Made

3,919/14. **Engine-starting and Car-lighting Apparatus.** WILLOCQ, REGNAULT & Co. This specification, which is for an arrangement of a combined starting motor and lighting dynamo on a transverse shaft in front of the bonnet, is to be amended by the insertion of a statutory reference to Patent No. 12,960/14 of H. J. O'Neill (New York).

Opposition to Grant of Patents

28,527/13. **Motor Control.** R. AMBERTON (Electrical Apparatus Co.). Opposition has been entered to a grant on this specification, which is for a rheostat interlocked with a circuit breaker so as to give a no-voltage release.

7,677/14. **Resistances.** J. COLLINSON. Opposition has been entered to a grant on this specification, which is for a method of construction of grid-type resistances.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

4,215/01. **Telephone Switches.** H. H. LAKE (*Telephonfabrik A.G. vorm J. Berliner*). Switchboard system for inter-communication telephones, in which the switches are mechanically interlocked, so that putting one on restores all others that may have been "on" to the "off" position.

4,330/01. **Radiator Lamp Contacts.** H. J. DOWSING. A system of lamp holders and caps for radiator lamps in which split contact pins in the holder engage in holes in the contact blocks of the lamp cap.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, Motors and Transformers: A. G., BROWN, BOVERI & CIE. [*A.G. Commutator machines*] 20,899/09.

Electrochemistry and Electrometallurgy: J. HÄRDEN [Electric furnaces] 26,251/09.

Switchgear, Fuses and Fittings: F. D. HALLOCK [Motor starter] 23,602/08.

Telephony and Telegraphy: A. T. M. JOHNSON and G. GUYOTT [Telegraphy] 22,924/01; AMERICAN AUTOMATIC TELEPHONE Co. and C. L. GOODMAN [Telephone selector switches] 25,896/09.

Traktion: B.T.-H. Co. (*F. E. Case*) [Multiple unit traction control] 22,543/01; B.T.-H. Co. (*A. S. Garfield and C. E. d'Ornellas*) [Train control] 22,546/01; J. SHAW [Collecting shoes] 24,630/03; W. R. SYKES [Signalling] 24,030/08; H. P. SAUNDERSON [Transmission gear for electric automobiles] 26,372/09.

Miscellaneous: WAYGOOD & OTIS [Electric lift control] 24,455/02; KELVIN & WHITE, F. W. CLARKE and L. W. P. CHETWYND [Ship's compasses] 25,718/09; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Electric propulsion of ships] 26,346/09.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,432.

How can one calculate the "whirling" or critical speed of a 5-ft. mild steel transmission shaft $1\frac{1}{2}$ in. diameter without any revolving masses on it (a) when running in plain bearing at each end, and (b) when running in freely swivelling bearings?—"UNIT POLE."

(Replies must be received not later than first post, Thursday, March 11th.)

ANSWERS TO No. 1,430.

Three rotary converters are run from a six-phase alternator, and are started up through low-voltage tappings. Resistances are inserted in these tappings, and have been burnt out in one rotary. Can this rotary be started up across high-voltage tappings, and if possible, what precautions are necessary in running up? The rotaries have A.C. voltmeters and ammeters on each panel. The alternator is excited by a shunt-wound exciter on the end of the shaft, and the voltage in the alternator is regulated by resistance in the exciter field, and may be further reduced by resistance inserted between the exciter and the rotor of the alternator. The other two rotaries can be shut down whilst running up.—"ROTARY."

The first award (10s.) is given to "ALPHA" for the following reply:

Only a small low-voltage rotary converter could be started up by throwing direct on to full line voltage; an ordinary machine would spark and damage the commutator surface, even if it did not actually arc over. In addition to this, a very heavy starting current would be drawn from the alternator, probably about four times normal full-load current. Resistances are not usually installed in the low-voltage tappings of tap-started rotaries, and it is probable that those mentioned by "Rotary" as having burnt out were inserted only to reduce the starting current, and that the rotary would start safely on the low-voltage tappings with the resistances cut out. No particulars are given in the inquiry from which one could judge whether this is the case, but if the rotaries start with the resistances without bad sparking or spitting, and the voltage drop across the resistance is not more than 10 or 15 per cent. of the (diametrical) slip-ring voltage, it would be safe to start without the resistances, at any rate temporarily, while they are being repaired. This, of course, would not interfere with the operation of the other machines.

An alternative, which would necessitate shutting down one of the other rotaries while starting up the faulty one, would be to run temporary connections from the starting switch of the faulty machine to the starting resistances of one of the other rotaries. The faulty machine could then be started by using the low-voltage tappings and resistance of the other machine and switched over on to its own full voltage (running) taps, leaving the starting tappings free for the other machine. If, as is almost certain to be the case, each rotary is normally supplied from separate windings, either on the alternator or a transformer secondary, it would

be necessary to use another triple-pole switch in addition to the usual starting switch, and to throw over both switches together, since all six phases of the rotary would have to be thrown over from the winding which was being used for starting to the normal running connections. It would be necessary to carefully check the phases of the temporary connections to ensure that the slip-ring which is connected to (say) phase A of the alternator in the running position is connected to the corresponding phase of the starting winding, and similarly with the other rings, otherwise there would be a danger of the rotary not being correctly in phase, and flashing over when the switch was thrown from the starting to the running position.

If neither of the above methods can be used, there is a third scheme, which would, however, necessitate shutting down both the other machines while starting up the faulty one. First note the voltage between two blades of the triple-pole starting switch at the moment of starting up one of the rotaries in the ordinary manner. The figure required is that to which the voltage drops when starting; it is not sufficient to measure the voltage before the switch is closed or after the machine has run up, as this would not allow for the drop in the resistances. To get this reading it may be necessary to temporarily reconnect one of the A.C. voltmeters. Next shut down this rotary and connect the voltmeter between the corresponding full voltage (running) contacts of the switch of the faulty machine. Reduce the alternator voltage until this reading is the same as that shown when starting the other rotary. The switch may then be closed and the rotary will start up and pull into synchronism in the usual way, when the alternator voltage can be brought back to normal. If it is necessary to slip a pole to reverse the D.C. voltage, this must be done while the set is running on reduced volts. If the rheostat capacity available will not reduce the alternator voltage sufficiently at full speed, the alternator speed must be reduced to give the correct voltage during starting, and must not be brought up until the rotary is running in synchronism and with correct polarity.

The second award (5s.) is given to "Electron," who writes as follows:—

It is impossible to give a direct answer to the problems which "Rotary" raises, because he does not afford sufficient particulars to enable this to be done. He speaks of low-voltage tappings, but does not explain whether these are taken from a transformer or not, as they may be, as it is a very unusual thing to have low-voltage tappings on a generator; but if there is a transformer, it is not clear why the generator should be wound six-phase; a three-phase generator would meet the case. Nor does he explain the function of the resistances.

In examining the situation, the first point to be considered is how the three rotary converters are run from the six-phase alternator. As the writer has explained in answer to Question No. 1,408, ELECTRICAL ENGINEERING, September 24th, 1914, there are only two ways of running rotaries direct from the generator without the intervention of a transformer: one is to have a separate winding for each rotary, while the second is to use the patented method with balancing coils described in the answer mentioned. In neither of these cases are resistances used, and why a resistance should be required to start up a rotary converter when low-voltage tappings—whether they be from the generator or transformer does not matter—are available, it is difficult to understand. Resistances are used for starting up and synchronising rotary converters by a patented method, the rotary converter being switched on to full voltage with the resistance interposed between itself and the transformer or generator. The resistance is then cut out and the rotary runs up to speed and falls into synchronism. But no low-voltage tappings are required by this method.

Fortunately, however, while it is not possible to diagnose the case, it is not difficult to prescribe a remedy. "Rotary's" problem, as he sets it out, is to start up one of the rotaries on which the starting device has suffered some damage. What that damage is the question does not make clear. But he tells us that the two other rotaries can be shut down whilst the one mentioned is being run up. A perfect remedy for his trouble is therefore available. All he has to do is to switch the rotary with the disabled starting gear direct on to the generator before the latter is started up, or alternatively while the generator is running on zero voltage. In the former case the rotary will come up with the generator, and in the latter it will be brought up to speed by raising the voltage. The precautions which have to be taken in starting up a rotary by this method are those

which obtain with a rotary converter started from low-voltage tappings or with a self-synchronising motor. If the rotary has a field-splitting switch, as it probably will have, in starting up from the A.C. side this should be opened during starting. After this rotary has been run up to speed, the other two machines can be then started by the existing method, whatever that may be.

A further alternative would be to run the converter up to speed from the high-voltage tappings at full pressure, inserting a temporary starting resistance in three of the phase leads. The three-phase main switch is first closed, the resistance gradually cut out until the rotary falls into synchronism, and the liquid starter short-circuited.

QUESTION No. 1,429.

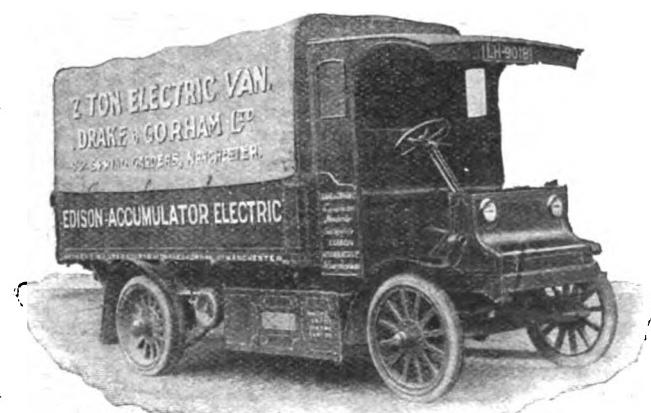
Prof. D. Robertson (Bristol) has written calling attention to the answers to above question given in our last issue. He says that although both are correct in referring the trouble to the

rotor voltage, they are incomplete for the following reasons : (1) A connection between one point of the rotor winding and the frame could not by itself produce any appreciable P.D. between the frame and earth. (2) The rotor voltage dies away gradually as the machine gets up speed, and does not disappear immediately the starter is put on the first step. To produce a live frame by connecting it to the rotor winding there must, in addition, be a connection to earth at some point of the rotor circuit outside the machine—say on the starting rheostat—and for the symptoms to disappear as soon as the rotor circuit is completed, the two points must be so placed that under the normal rotor currents they take the same potential. The true solution to the riddle is that the neutral point of the rotor winding is connected to the frame, probably intentionally in order to limit the voltage of the slip-rings to the frame to that of one rotor phase. The free end (that is, the end which the starting switch touches on the first step, and which then becomes the neutral point of the starting rheostat) of one leg of the resistance has also gone to earth.

"ELECTRICAL ENGINEERING" TRADE SECTION

AN ELECTRIC DEMONSTRATION VAN

IN view of the increasing interest that is being evinced in the great possibilities of electric battery vehicles, Messrs. Drake & Gorham, Ltd. (47 Spring Gardens, Manchester), are conducting an energetic campaign towards popularising the use of electric vans in Lancashire and Cheshire, and to this end have acquired a demonstration van having a loaded capacity of two tons. This van, which is illustrated here, has a body of special design, and can



EDISON BATTERY DEMONSTRATION VAN.

be arranged to be used as a covered van and open waggon or a flat lorry. The motive power is derived from a battery of Edison accumulators carried in a cradle below the van body. The side doors of the cradle—which is fitted with steel compartments—are under-hinged, and, when open, the accumulators can be withdrawn laterally for inspection. The compartments are dust-proof and water-proof, though well ventilated. The motor is of the totally enclosed traction type, and drives through a differential gear to a lay shaft and thence by roller chains to the rear wheels.

The Ediswan Works.—The Edison & Swan United Electric Light Co.'s Ponders End Works, Middlesex, were visited on Wednesday of last week by the members of the Chemical Society, Royal College of Science, South Kensington, Mr. E. W. Swann, their Excursion Secretary, being responsible for the arrangements. An interesting visit was made to all the lamp manufacturing departments, including carbon and drawn wire sections.

Roll of Honour.—The British Aluminium Co., Ltd., have issued a Roll of Honour of artistic design containing the names of over 350 men from their various factories, office staffs, &c., who are serving in the forces of the Allies. In addition to these some 85 men left at the beginning of the war to join their regiments, but their exact position cannot be traced.

CATALOGUES, PAMPHLETS, &c., RECEIVED

BATTERY LAMPS.—A catalogue from the Essex Accumulator Co. (697/9 Grove Green Road, Leytonstone, N.E.), gives particulars of a large number of patterns of self-contained battery lamps, both with accumulators and with dry cells, including the ordinary types of torch and pocket lamp, as well as many well-made portable lamps for special purposes, among which we notice in particular several in leather cases with straps for military work with batteries of considerable capacity and spare lamp bulbs all ready in holders within the case.

SWITCHBOARDS.—A leaflet from J. H. Holmes & Co. (Newcastle-on-Tyne) illustrates a variety of typical switchboards built by them, including both high- and low-tension gear, and the special ironclad draw-out gear for substation work, &c., which they have recently developed.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

TIDE TABLES.—We have received from Alfred Graham & Co. (St. Andrew's Works, Crofton Park, S.E.), who specialise in telephone equipment for marine purposes, a copy of the useful little pocket-book which they issue annually containing speed and tide tables for the principal seaports in the United Kingdom, and a quantity of special port information, &c. A glossary of electrical terms and other selected engineering data are also included. The company have also been kind enough to send us one of their conveniently arranged blotters with diary attached.

AIR FILTERS.—Catalogues from the Premier Cooler & Engineering Co., Ltd. (Broadway Court, Westminster), contain particulars of their wet- and dry-air filtering equipments for dealing with the ventilating air for large turbo-generators and similar purposes.

TRACTION BATTERIES

WE have received a long letter from Mr. R. J. Mitchell (Commercial Engineer, Edison Accumulators, Ltd.) commenting on some statements which have appeared in our contemporary, the *Commercial Motor*, in an article on "The Choice of a Battery." Mr. Mitchell refutes the statement that the lead battery is more popular than any other in this country for electric vehicles by remarking that about 90 per cent. of all commercial electric cars in Great Britain are equipped with the Edison accumulator. One firm alone will shortly have nearly 50 Edison battery vehicles. There should be no difficulty in deciding what type of battery to employ if it is required to run a vehicle at the least possible expense. His Company, he intimates, are prepared to back this opinion with actual guarantees. There is only one lead battery, he says, sold for traction purposes in this country with a guarantee, and this is on the basis of 80 per cent. of the rated capacity after two years' service. The majority of lead batteries, he says, have to be exceedingly well looked after

to give 8,000 to 10,000 miles' service under commercial conditions. Now the Edison battery (which, according to the *Commercial Motor*, "must of necessity be replaced at the end of four years, whether used or not") is founded on a chemical principle preserving it from all but the slightest traces of deterioration on open circuit, and is guaranteed to give its full capacity after four years' service with no plate renewals. Cases are mentioned of batteries which, after running 50,000 miles in five years, have been found to have a capacity of 10 per cent. above their original rating. It is quite true, continues Mr. Mitchell, that most lead accumulators maintain their voltage better on very high rate discharges, but against that must be set the fact that it is very detrimental to the cell to take heavy currents therefrom, whereas he claims that the Edison cell may be completely short-circuited and left out of commission if necessary for an indefinite period without harm. He points out the further advantages of the Edison cell in that it can stand charging at a rate that would mean destruction to a lead cell, and its immunity from damage due to long-continued vibration. Moreover, the Edison cell uses a steel preserving electrolyte in place of acid, which in itself eliminates a number of minor disadvantages. Again, while the general upkeep of the Edison cell involves merely charging as and when required, and the simple precaution of not allowing the exterior of the cells to become dirty and wet, the procedure in the case of the lead battery is relatively complex, and involves a number of "douts" which may be ignored with a steel battery. It is also much easier to judge of the state of charge of an Edison cell by means of an ampere-hour meter, because the ampere-hour capacity is nearly constant for all rates of discharge. Finally, an Edison cell is quite unharmed by being discharged to complete exhaustion and left in that state for long periods.

Mr. Mitchell encloses the following table of comparative weights of Edison cells and two well-known makes of lead cell :—

| Make of Battery. | Rated Output in kw.-hours. | Gross weight in lbs. | Weight in lbs. per rated kw.-hours. |
|------------------------|-------------------------------|-------------------------|---|
| Ironclad | 10·6 | 1,350 | 127 |
| El.S.B. Co. Thin Plate | 12·8 | 1,350 | 105 |
| Edison A-4 | 10·8 | 900 | 84 |
| Ironclad | 13·2 | 1,620 | 123 |
| El.S.B. Co. Thin Plate | 17·1 | 1,720 | 100 |
| Edison A-5 | 13·5 | 1,100 | 82 |
| Ironclad | 18·5 | 2,200 | 119 |
| El.S.B. Co. Thin Plate | 21·4 | 2,100 | 98 |
| Edison A-6 | 16·2 | 1,260 | 78 |
| Ironclad | 23·8 | 2,750 | 115 |
| El.S.B. Co. Thin Plate | 27·8 | 2,650 | 96 |
| Edison A-8 | 21·6 | 1,820 | 84 |
| Ironclad | 26·4 | 3,080 | 117 |
| El.S.B. Co. Thin Plate | 32·1 | 3,080 | 96 |
| Edison A-10 | 27·0 | 2,250 | 84 |
| Edison A-12 | 32·4 | 2,700 | 84 |

Arrangements for the Week.—(To-day) Thursday, March 4th.—Greenock Electrical Society, 21 West Stuart Street. "The Operation of a Large Electric Supply System," by G. Macdonald. 7.30 p.m.

Tuesday, March 9th.—Institution of Electrical Engineers, Manchester Section, at Engineers' Club. "Electricity Applied to Mining," by C. P. Sparks. 7.30 p.m.

Institution of Electrical Engineers, Scottish Section, at Princes Street Station Hotel, Edinburgh. "Automatic Protective Switchgear for Alternating Current Systems," by E. B. Wedmore. 8.10 p.m.

Wireless Society of London, at I.E.E., Victoria Embankment. "Waves," by Dr. J. Erskine-Murray. 8 p.m.

Wednesday, March 10th.—Institution of Electrical Engineers, at Philosophical Hall, Leeds. "Electric Cooking Mainly from a Consumer's Point of View," by W. R. Cooper. 7 p.m.

Royal Society of Arts. "Patent Law Reform and the War," by J. W. Gordon, K.C.

Thursday, March 11th.—Institution of Electrical Engineers. "Electric Cooking Mainly from a Consumer's Point of View," by W. R. Cooper.



TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Blackburn.—The Borough Electrical Engineer is working out details of a new power house. The estimated cost is £100,000.

Dover.—The Borough Electrical Engineer has recommended the installation of a 1,000-kw. turbo-alternator set with accessories at an estimated cost of some £6,000. He estimates a saving in running costs of £400 per annum with coal at 16s. 6d. per ton, the average normal price, or £485 with coal at £1 per ton.

Hull.—Extensions to the generating plant at an estimated cost of £41,500 have been approved. A 5,000-kw. turbo-alternator is recommended, with two water-tube boilers, coal-handling gear, cooling pond, &c.

Knaresborough.—The Council has agreed with the Harrogate Corporation as to the area within which the latter shall give a supply.

Leeds.—The Council has sanctioned the application for a loan of £200,000 for mains extensions, transformer substations, a new turbo-alternator and condensing plant, &c.

London: Stepney.—The Finance Committee of the L.C.C. recommends sanction to a loan of £15,000 for mains, feeders, and general extensions.

Londonderry.—Twelve months' supply of cable, meters, carbons, house fuse-boxes, &c. Borough Electrical Engineer. March 13th.

Manchester.—Three three-wire balancers. City Electrical Engineer. March 10th.

Newcastle-on-Tyne.—In order to provide additional machinery, the directors of the Newcastle & District Electric Lighting Co. will shortly be asking its shareholders to sanction an increase in borrowing powers.

Norway.—The Christiania Municipality requires 148,000 metres of high- and low-tension cable. Kristiania Elektricitetsverkets Expeditionskontor, Christiania. March 25th.

Plymouth.—An expenditure of £280 upon repairing cable on two sections of the network has been sanctioned.

Wiring

Burnley.—Electric light work. Clerk to Guardians. March 22nd.

Leeds.—Electric lighting at the workhouse.

Manchester.—Lighting of new ward pavilions and isolation block at Monsall Hospital. Town Clerk.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bradford.—Business premises. Architect, James Young, 62 Market Street.

London: Deptford.—Baths, washhouses, and branch library. Evelyn Street. Town Clerk.

Swindon.—Factory for Imperial Tobacco Co.

Miscellaneous

Belfast.—Three, six, or twelve months' supply of electric lamps for the Municipal Sanatorium. Town Clerk.

Dublin.—Twelve months' supply of electrical fittings for South Dublin Guardians. Clerk, James's Street. March 10th.

Ilford.—Electric coal waggon for Electricity Department. Borough Electrical Engineer. March 9th.

Liverpool.—Twelve months' supply of electrical fittings for Poor Law Institution, Brownlow Hill. Clerk. March 12th.

Warrington.—Twelve months' supply of electrical goods for Guardians. Clerk, Bewsley Chambers.

The Institution of Civil Engineers.—H.M. the King of the Belgians and also Admiral Lord Fisher, First Sea Lord of the Admiralty, have accepted election as Honorary Members of the Institution of Civil Engineers.

Siemens' Dance.—A most successful dance was held at Mozart House, Albion Road, N.E., on Friday last, by members of the Siemens Dalston staff, and the company of about 70 who assembled much enjoyed the evening, which was made all the more interesting by some special features such as a "Mysterious Waltz" and a "Twilight Waltz," by the subdued light of multi-coloured lanterns. Great credit reflects upon the efforts of the committee, which consisted of Miss Maloney, Miss Topper, Mr. Dennison, and Mr. Pryor.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Blackpool.—The Electricity Committee has accepted the tender of the Davenport Engineering Co. for a cooling tower.

Bolton.—The tender of the British Thomson-Houston Co. has been accepted for the supply of switchgear.

Croydon.—A contract has been placed with Messrs. Babcock & Wilcox for a boiler, superheater, and economiser at £4,295; two chain-grate stokers at £920; and a motor-driven induced draught plant at £795.

Ipswich.—Ten tenders were received for coal-handling plant, and that of Messrs. Fraser & Chalmers has been accepted at £2,320 10s.

Tunbridge Wells.—The following tenders have been accepted:—Two water-tube boilers, the Stirling Boiler Co.; water-cooling towers, Messrs. Witting & Partners.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. A. Campbell Swinton has been recommended for election as a Fellow of the Royal Society.

Switchboard attendants are required by the Blackpool Tower Co. and the Heywood, Bermondsey, and Portsmouth Electricity Departments.

The Accrington Electricity Committee recommends that Capt. Gray, the Chief Electrical Engineer, now on active service, shall have his army pay supplemented by a sum to make it equal to the salary he has received hitherto.

Mr. J. R. Lilleker has been appointed Assistant Electrical Engineer at Rotherham in succession to Mr. J. Williams, now Engineer and Tramways Manager at Erith.

LOCAL NOTES

Belfast: *Extensions Postponed Again.*—At the last monthly meeting of the Corporation it was announced that the proposed electric supply extension scheme at an estimated cost of £28,000 is not to be proceeded with for the present.

Coventry: *Lighting Small Property.*—A scheme has been prepared for giving a supply of electricity to workmen's dwellings on the following basis:—During May, June, and July the charge will be 6d. per week for houses with three lights and 7d. four lights; during April, August, and September, 7d. and 8d.; February, March, and October, 8d. and 10d.; November, December, and January, 9d. and 11d. Alternatively, a flat rate throughout of 7½d. per week for houses with three lights and 9d. per week for four lights is suggested. The charges include the provision and maintenance of lamps.

Darwen: *Coal Supply.*—The coal contractors to the Electricity Committee have notified that, owing to the reduction of output through workmen enlisting, they are compelled to reduce the supply by 25 per cent., or to charge 1s. 6d. per ton over the contract price for any coal delivered over 75 per cent. of the contract quantity.

Dublin: *Further Increased Charges.*—The Electricity Committee has created considerable concern among its consumers by announcing that it is compelled to increase the charges by a further ½d. per unit to that reported in our last issue, as far as lighting is concerned, and a further ¼d. per unit for power supply, making a 1d. and a ½d. increase respectively.

Llandudno: *New Plant.*—An additional 300-kw. generating set with induced draught plant has been ordered.

Rotherham: *Fire at Electricity Works.*—On Friday an accident to a rotary converter resulted in the dry air filter in connection with the turbo-alternator catching fire. Some damage was done. Mr. E. Cross, the Borough Electrical Engineer, and his staff were able to maintain the lighting supply, but the high-tension supply for power purposes had to be shut down until next morning.

Stoke-on-Trent: *Large Power Supply.*—A recommendation by the Electricity Committee that current should be supplied to Messrs. Keeeling & Walker, who propose to work a new electro-chemical process in the town, at a flat rate of ½d.

per unit, was the subject of considerable discussion at the last meeting of the Corporation. The supply, however, will commence at 3,000 units per week taken continuously over 132 hours weekly at E.H.T. three-phase. There is every prospect, according to the negotiations which have taken place, of the supply reaching 6,000 units per week, and it was explained on behalf of the Committee that the revenue from this will be a distinct income, as the current will be taken during the day-time principally. The recommendation has been sanctioned.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Harrods' Stores.—In the course of the meeting on Friday last, the chairman (Sir Alfred J. Newton) referred to the fact that the whole of the electricity for lighting and power is generated on the company's own premises at a cost comparing very advantageously with what they would have to pay to an outside company. The amount used would be sufficient to supply a provincial town of some 80,000 inhabitants.

Westminster Electric Supply Corporation.—The question of coal supply was dealt with by the Chairman and also by Sir Alexander Kennedy, F.R.S., the company's chief engineer, at the annual meeting on Wednesday last week. During the last half of 1914 coal cost the company 8d. per ton more than in the last half of 1913, but during the past six weeks there has been an increase of about 3s. The company has considerable reserves, and the Government has now put some ships at the service of electric lighting and gas companies, but as we have already pointed out, however, the freights on these are much higher than upon the boats taken from the companies compulsorily by the Government. As to the position of electric power supply in London, the Chairman merely remarked that the companies have withdrawn their Bill in deference to the wishes of the Government owing to present conditions.

The I.M.E.A.—In view of present circumstances, the Council of the I.M.E.A. has decided not to hold a Convention this year. As already mentioned in our columns, the President, Major H. Richardson, is on active service, and it is the intention to hold business meetings in London on Thursday and Friday, June 17th and 18th, for the transaction of routine business necessitated by the Articles of Association, and for the discussion of matters of general interest to the members. These meetings will be held at the Institution of Electrical Engineers, Victoria Embankment, and on Thursday, June 17th, a report prepared by Mr. A. S. Blackman (Chief Electrical Engineer, Sunderland) and Mr. T. Roles (Chief Electrical Engineer, Bradford), on behalf of the "Point-Five" Association, on "The Practical Result of the 'Point-Five' Tariff," will be read and discussed. In the afternoon a report by Mr. F. Ayton (Chief Electrical Engineer, Ipswich), on "The Use of Electric Vehicles in Municipal Services," will be presented, and there will afterwards be a parade and demonstration of electric vehicles. On Friday, June 18th, the Annual General Meeting will be held.

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £69 5s. to £69 15s. This is the same price as last week. By an unfortunate clerical error, the price last week was given erroneously as £59 5s. to £59 15s.

London Power Supply.—The L.C.C. has officially notified the London borough councils that, although its power Bill has been withdrawn this session, consideration is still being given to the question of what further action, if any, shall be taken with regard to the supply of electricity in and near London. Local authorities wishing to make observations on the subject are requested to submit them as soon as possible.

Wiremen's Wages.—The General Purposes Committee of the L.C.C. has recommended that 10½d. per hour and the hours of labour and rate of pay for overtime in accordance with the rules agreed between the London Electrical Masters' Association and the Electrical Trades' Union in August, 1914, be adopted.

Inquiries yesterday showed that the Electrical Trades' Union have not yet made their application to the London Electrical Masters' Association for the increased rate to 1s. per hour referred to in our last issue.

ELECTRICAL ENGINEERING

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SUMMARY

WE publish a translation of an article from the *Berliner Tageblatt* on the efforts of Great Britain and America to make a permanent capture of Germany's electrical export trade. The article suggests that the "Kultur" should no longer be measured by the use of soap, but the consumption of electrical energy per head of population. On this basis Germany possibly comes out higher than England—the results of the soap test are not given in the article (p. 102).

No further loans to local authorities for extensions of electricity works, cable networks, &c., will now be sanctioned unless they are for the purpose of enabling Government contracts to be fulfilled. The situation, which will have a far-reaching effect on electricity supply undertakings, is reviewed in a special article on pp. 102 and 103.

WE are able this week to publish some further particulars with regard to the deputation to the Board of Trade on the question of coal supplies, and we also explain the true reason for the enormous increase in prices and the difficulties in obtaining deliveries of coal under contracts (p. 103).

IN a paper read before the Manchester Local Section of the Institution of Electrical Engineers, Mr. A. P. M. Fleming dealt with the training of youths for the industrial side of engineering (p. 104).

A FULL list of members of the I.M.E.A. Development Committee is given on p. 104.

OUR report of the petition for compulsory licences under the drawn-wire metal filament lamp patents

gives a résumé of the further evidence on behalf of the petitioner. Evidence for the respondents has not been called for at present, and the judge is considering the case (p. 105).

THE Oldham Chamber of Trade write objecting to some of the statements made in our article on "The Electrical Contractor and his 'Rights,'" in our issue of February 25th (p. 105).

THE chairman's address of Mr. W. H. Everett to the Calcutta Local Section of the Institution of Electrical Engineers contained a general review of electrical engineering in India ((p. 105).

A METER problem is discussed in our "Questions and Answers" columns (p. 106).

THE corrosion of iron pipes by tramway return currents was dealt with by Mr. H. E. Yerbury in a Paper read recently before the Institution of Civil Engineers. A paper by Mr. A. F. Bound urges the adoption of track circuit signalling on railways (p. 107).

AMONG the subjects of Specifications published last Thursday by the Patent Office are control of traction motors led by mercury-vapour rectifiers, the control of lighting circuits automatically by selenium cells, and the fixation of nitrogen. An application has been made for the suspension of an enemy-owned patent for sparking-plugs. Patents dealing with maximum demand indicators, instruments, and telegraphs are expiring after a full life of fourteen years (p. 108).

A DISCUSSION on communications in warfare has been held by the Students' Section of the Institution of Electrical Engineers (p. 109).

THE prospects of an increased electrical trade with Canada are extremely good. It will have to be sought, however; it will not come automatically. An interview with Mr. Hamilton Wickes, H.M. Trade Commissioner in Canada (who is now in London) appears on p. 109.

OUR Trade Section describes a new design of exciter field regulator and a charging apparatus for small cells (p. 110).

MAINS, services, and transformers are required at Darlington; a 500 kw. mixed pressure turbo-alternator at Hove; and mains, services, and meters at Kingston-on-Thames. Extensions are also contemplated at Hackney, Batley, Heywood, Wednesbury, and Barking. Hackney has borrowed £10,000 from the bank for extensions (p. 111).

THE award in the Kingstown arbitration is £3,068.—An inclusive tariff for hired cooking and heating apparatus has been discussed at Marylebone (p. 112).

AN increased dividend is paid by the British Insulated & Helsby Cables, Ltd., for 1914. The Metropolitan Electric Supply Co.'s dividend is one per cent. down (p. 112).

(For Arrangements for the Week see p. 112.)

THE UNIT OF "KULTUR": SOAP OR ELECTRICITY?

IT is estimated that the production of one of our greatest concerns, for instance, the Allgemeine Elektricitäts-Gesellschaft, would be sufficient to cover the whole requirements of England, for, in the year 1912, the consumption of electrical goods in England was only 3s. 2d. per head of population, as against 16s. in Germany. This throws an accidental light on the glorified 'Kultur' of the English people, for to-day, not merely the use of soap, but also the distribution of electrical energy can be designated as the measure of outward 'Kultur.'

This remarkable passage occurs in an article in a recent issue of the *Berliner Tageblatt*, which has been cut out and sent to us by one of our Swiss correspondents. The article, obviously intended for German and not British readers, is a clumsy endeavour to belittle the importance of our electrical industry, for in the attempt to prove its case, the Berlin paper quotes figures which show in themselves that this industry has afforded an enormous market for Germany, having bought, in fact, £1,721,000 worth of electrical goods from that country in 1913; this represents about 10 per cent. of Germany's total export of electrical goods.

The article, in the true unwashed spirit of German "Kultur," makes no bones about attacking the English industry from which Germany has derived so much profit in the past, and as it gives other interesting figures—and even expresses some home truths—we think it will interest our readers to have a translation of the remainder of it practically in full:—

"In 1912 the estimated value of electrical apparatus exported by Germany was £13,600,000, or 22½ per cent. of its whole production. In 1913 the value rose to £16,500,000. It can thus be assumed that the percentage of export by our bigger concerns is still greater, while, on the other hand, it is to be noted that, contrary to America, electrical firms of moderate and small size take their part to a larger extent, thanks to the excellent organisation of the German export trade." [The logic of this argument appears somewhat faulty.] "A considerable part of our export, well over half, crosses the ocean, while 35 per cent. went to the European countries at war with us, and 7 per cent. to Austria-Hungary. The value of the German exports to the hostile European states during 1913 was as follows: Belgium, £1,087,000 (being 6·58 per cent. of the total electrical exports from Germany), France, £915,000 (5·56 per cent.); England, £1,721,000 (10·41 per cent.), Russia, £1,980,000 (11·98 per cent.), Serbia, £14,600 (0·09 per cent.).

"England is trying to supplant German competition in electrical, as in all other industries, from the markets of the world, during the war, although she had to give way to this competition in times of peace, owing to the superiority of German goods and business methods. . . . England must import one-fifth of her own requirements, and in this fifth part Germany had a constantly increasing share.

"The electrical factories in England wish to replace German imports as much as possible by their own products, but it is admitted from the English side that they are not quite in a position to do so. The English works are short of skilled workmen, but the chief reason is that they are dependent on raw materials and component parts, which they have hitherto exclusively obtained from Germany, Austria, Belgium, and Sweden. For instance, only two incandescent lamp works made their bulbs themselves in England, while all others obtained theirs from the continent. There is only one arc lamp carbon factory in England, so that nearly all arc lamp electrodes must be imported. England has also hitherto been dependent on other countries for certain qualities of iron and steel, porcelain and glass parts, which, it is true, could be made in the country, but it is clear that such auxiliary industries cannot be suddenly evolved, and that years must elapse before a change can be made. With such obstacles it is easy to see that England's efforts to usurp our electrotechnical export, especially to oversea countries, will not have much success.

"During 1913 England exported something over £500,000 worth of electrical goods to South Africa, while the exports of Germany and Austria to those countries was valued at £425,000. Electrical machines constituted the major part of this export from Germany, this part being double as great as that delivered from England. It is characteristic that, according to the English Board of Trade, the foreign, and thus primarily the German merchants, achieve their success by holding large stocks, so that the mines can be supplied quickly. On the other hand, it is not mentioned in the English report, that the successes in the supply of machines depended on the excellent quality of the machines and on the technical thoroughness of the installations." [The Board of Trade reports state facts only.] "We need merely recall the large deliveries of steam turbines, turbo-compressors, and haulage installations which have in recent years been made from Germany to the Rand mines.

"The American electrical industry is naturally giving particular attention to the present circumstances. The American electrical export is relatively small, and last year amounted only to about £5,000,000. In addition it showed a tendency to diminish. The Americans hope to increase these figures during the war, but time alone can show to what extent the trade which they have perhaps now won will be retained. Their greatest hopes are placed in the Far East and in South America. According to the Japanese Consul in Chicago the electrical imports into Japan during 1913 amounted to about £1,375,000, of which only 20 per cent. was from the United States, 30 per cent. from England, and 50 per cent. from Germany. In Central and South America, the position is better for America. From July 1st, 1912, to June 30th, 1913, the imports for the most important countries are estimated as follows:—

Mexico: From Germany, £100,000; from England, £10,500; from America, £420,000.

Argentina: From Germany, £812,500; from England, £600,000; from America, £125,000.

Brazil: From Germany, £350,000; from England, £362,500; from America, £628,000.

Chili: From Germany, £250,000; from England, £135,000; from America, £250,000.

Total for the above four countries: From Germany, £1,512,500; from England, £1,108,000; from America, £1,423,000.

"Germany was certainly ahead here, and although it is maintained on the American side that it is now possible to gain the exports hitherto derived from England and Germany, yet this should hardly be possible. Above all, the receptive capacity of the Central and South American States is momentarily very small, as they have all been visited by severe commercial and financial crises. Exports to Mexico should be absolutely impossible under present political conditions. In addition there are the financial and transport difficulties. The Argentine Ambassador to the United States calls American merchants' attention to the fact that a payment 90 to 120 days after delivery is regarded in the Argentine as a cash payment, although this would be regarded as credit by American manufacturers. On all sides it is acknowledged that it is not only the German goods, but also the cleverness of the German business methods which have won their successes in export trade. The Secretary of the Department for Commerce of the United States explains that, particularly with regard to the South American market, a scheme which has a German financial backing, and is carried out under the direction of German engineers, will definitely call for German material. He urges the business and banking world of the United States to enter territory which is foreign to them by investment of capital in the South American States, as they then will obtain not only interest for their money, but also an increased sale of American goods. It is questionable, however, whether this appeal will have any effect, in view of the financial position in the South American republics already referred to. We have good reason to hope that our exports to these countries, which has not absolutely ceased during the war, will not only attain its former extent after the war, but will develop to an increasing extent."

Another leading German newspaper, the *Frankfurter Zeitung*, gives some significant information with regard to the probable future position in Russia, information which would appear to be accurate:

At a meeting of the Electrical Section of the Royal Russian Technical Society, attended by a representative gathering, the subject discussed was the means to make the Russian electrical industry independent of Germany in the future. One speaker stated that hitherto the Russian electrical industry had been almost completely under the control of Germany, and that actually the tungsten mines in the Ural district were owned by Krupp's.

EXTENSIONS OF ALL ELECTRICITY WORKS TO BE RESTRICTED

THE Government has decided that no loans for the purpose of expenditure on extensions to electricity works are to be authorised unless these extensions are required to enable firms engaged on Government contracts to continue their operations. This important announcement has been made in three places during the past week: by Mr. H. Ross Hooper at a Local Government Board inquiry at Heywood (Lancs.), in the Private Bill Committee Rooms in the House of Commons, and in a report by the Finance Committee of the L.C.C.

At the Local Government Board inquiry at Heywood last Friday, with regard to an application for sanction to borrow £12,480 for the electricity undertaking, Mr. H. Ross Hooper, chief inspector of the Local Government Board, stated that, acting in conjunction with the Treasury, the L.G.B. would sanction no loans for electricity works extensions except in

extraordinary circumstances involving facilities for the execution of Government contracts. Loans for expenditure on ordinary developments would not be sanctioned, but such work might be paid for out of revenue. The Chairman of the Electricity and Tramways Committee asked the definite question: "Are we not to supply fresh consumers who are making demands upon us?" and received the point-blank reply from Mr. Hooper: "Not if you cannot do it with your present works. You will have to tell them they must do without what they are asking for until the war is over."

The Treasury has been in communication with the Parliamentary authorities regarding restrictions to be placed upon the expenditure of money under Private Bills or Provisional Orders. As a consequence, there will be inserted in all Private Bills this session a clause to the following effect:—"During the continuance of the war, and twelve months thereafter, the consent of the Treasury shall be required to the raising or borrowing of any money under the powers conferred by this Act (or Order)."

At the meeting of the London County Council on Tuesday, the Finance Committee reported with regard to applications from Borough Councils for certain loans, including £5,000 for electricity mains at Battersea and £10,000 for the Hammersmith electricity undertaking. A communication had been received from the Treasury stating that Treasury approval is now required for all fresh borrowings by Local Authorities, and that approval would not be forthcoming in the absence of special considerations, and requesting that the applications for the loans in question should be reconsidered accordingly.

The position is summed up in the following official instruction:—"The approval of the Treasury should be obtained for all fresh issues of capital of whatever nature, whether made on behalf of a Government, municipality, or other public body, or any company, whether public or private."

The Hammersmith Borough Council will be placed in a peculiar position if the loan is refused, as the bulk of the money is required for mains and transformers, which have already been purchased; about a quarter of it was in order to keep a sum in hand for future extensions, so that in future there might be no expenditure in advance of their borrowing powers. Fortunately, the Council have a reserve fund which can be drawn upon in the event of the loan being refused. In Battersea, on the other hand, we believe that at any rate part of the expenditure contemplated is for the purpose of supplying power for the execution of Government contracts.

It is clear that the position will be a very difficult one for electricity undertakings. Fortunately, the "linking-up" scheme in London (see ELECTRICAL ENGINEERING, February 11th, p. 56), which is absolutely essential at the present time, will cost very little, and it will be immaterial whether this is paid for out of revenue or reserve fund if sanction for loans for capital expenditure is refused. The problem of dealing with applications for supply from new consumers, and for extensions by existing consumers is more complicated, however. To a certain extent these can be supplied by existing plant, and mains, &c., and can also to a limited degree be paid for out of revenue, but as the period during which no loans are to be sanctioned is indefinite, electricity undertakers will have to go cautiously. It has been suggested that application might be made to permit the suspension of contributions to sinking fund, but we hardly think that this would be permitted, as it would simply be prolonging the period of past loans, and would therefore have all the same objections from the Treasury point of view as sanction to a new loan. It is, however, an occasion upon which reserve funds should certainly be drawn upon for capital purposes, and also a firm stand should be taken against allocating any profits that may be made to relief of rates.

It will be interesting to see whether, in cases such as at Hammersmith, where the money applied for has been already partly spent on extensions to networks, &c., the loan will be allowed when the full circumstances are reported, or whether the money will have to come out of revenue or reserve fund. Another problem that will arise is whether it will not be necessary for some electricity works to reduce the number of their cable hands and canvassing staffs if practically all extension work has to be stopped.

We have already mentioned, but it will bear repetition, that no difficulties are likely to be placed in the

way of extensions for the genuine purpose of supplying power to firms engaged on Government contracts, whether for munitions of war, clothing, or other War Office necessities. If the extensions are required for such purposes, the details should be made clear and definite with the application for the loan, so that there may be no delay.

One point more must be mentioned. It is evident that some definite instances will arise in which electricity authorities, both company and municipal, will be unable to comply with requests for supply from new consumers, and will also have to refuse to consider extensions to existing ones. In these circumstances they might become liable to an action for not fulfilling their statutory obligations under the Electric Lighting Acts,* and a short Act of Parliament will be necessary to relieve them of this possible difficulty.

COAL SUPPLIES: DEPUTATION TO THE BOARD OF TRADE

A S announced briefly in our issue of last week, a deputation of electricity and gas works managers was received by the President of the Board of Trade on Wednesday last week, to lay before him the serious position with regard to coal supplies:

The deputation had been arranged primarily by the gas interests, and there were present representatives of the Institution of Gas Engineers, the Gas Companies' Protection Association, and the Conference of Gas Authorities in Scotland; Messrs. Bowden (Poplar), Calvert (Finchley), and Tapper (Stepney) attended as representatives of the Association of Municipal Electrical Engineers (Greater London), and Mr. Barge (Chairman of the Poplar Electricity Committee) for the Conference of Metropolitan Authorities owning Electric Supply Undertakings. Neither the Institution of Electrical Engineers nor the Incorporated Municipal Electrical Association, we believe, were invited to send official representatives, but Mr. Frank Bailey (City of London Electric Light Co.) was summoned by the gas companies at the last moment to speak on behalf of the electric lighting companies.

Sir Fortescue Flannery, Bart., M.P., introduced the deputation, and briefly mentioned that the electric light and gas undertakings were both affected by the present position. Sir Corbett Woodall (Gas Light & Coke Company) spoke first on the question generally, and was then followed by Dr. Carpenter (South Metropolitan Gas Company), who said that the South Metropolitan used a million tons of coal a year. He mentioned the importance of instructing the public as to the utilisation of coke, and said that in Germany no fuel was allowed to be burned in open grates unless it consisted of two-thirds coke. Another point which he raised was that a large amount of the bye-products of the gas works was required by the Government for the manufacture of explosives.

All the speakers explained the difficulties under which they were working owing to the shortage of coal supply, and although the high price of coal was incidentally alluded to, the main object of the deputation was to impress upon the Government the necessity of some steps being taken to facilitate and accelerate the transit of coal from the mines to the gas and electric light works. Mention was also made of the distress which the shortage was causing among the poorer classes. Mr. H. E. Jones (Commercial Gas Company) said that the Commercial Gas Company had 114,000 consumers, chiefly of the poorer class, 90 per cent. of whom were supplied through slot meters.

Mr. Frank Bailey said that until the present emergency the electric lighting companies had always had ample stocks of coal, but these were now getting seriously depleted. He mentioned that his Company supplied power to a large number of the newspapers in Fleet Street, who would be unable to print if the Company were prevented from supplying, due to coal shortage, and Mr. Runciman, in the course of his reply, caused some amusement by saying that perhaps the Censor's department would not mind this.

Mr. E. Allan (Past-President of the Institution of Gas Engineers) asked the Board of Trade to do all in its power to get as many as possible of the coal trucks which were being used exclusively for Government purposes released, as the holding up of these trucks had been one of the most serious causes of the trouble.

Bailie Irwin (Glasgow) said that in his city there are 290,000 consumers, 80,000 of whom were supplied through slot meters, and that the gas works used a million tons of coal a year. At one time their stock of coal had been nearly down to a fortnight's supply.

The President of the Board of Trade (Mr. Runciman) replied

* Electric Lighting (Clauses) Act, Sections 27 and 30.

only very briefly to the deputation, as he had another deputation waiting to see him upon a different subject. He referred to the difficulty of obtaining railway trucks, promised to give his best consideration to the facts placed before him, and said that he would be pleased to receive any further suggestions that might be put forward.

Before Mr. Runciman retired, Mr. Barge reminded him that several of the electricity works required coal to enable them to supply electrical energy to works which were engaged in executing Government contracts.

The arguments put forward by the deputation and the speeches made, unfortunately did not suggest any definite practical remedies which can be applied immediately. Energetic Government intervention is needed in two directions. In the first place, the carrying out of contracts made since the outbreak of the war should be insisted upon, and, in the second place, change in the destination of the coal before it reaches the original purchaser must be prevented. A step in the latter direction has already been taken by the Railway Executive Committee, who will now not accept transfers of coal, and have insisted since March 1st that all wagons must be labelled direct from the colliery to the consumer.

At a certain time last November, the supply of coal produced from the pits exceeded the demand, prices were exceptionally low, many users took advantage of the opportunity for ordering, and, in consequence, stocks accumulated at the railway sidings and yards. Then came the shortage, due to the diminished railway facilities, and wagon hire rose from the usual 9d. a ton to 2s. and even 8s. per ton. The coal factors, faced with the shortage, could not resist the temptation of raising prices and transferring coal on order under contracts to other customers who were ready to pay these higher prices. We know of one case in which a contract was entered into for coal last November at 10s. 9d. per ton; deliveries under this contract are already over 2,000 tons in arrear, and the works which had ordered it has actually been obliged to purchase coal—perhaps even its own coal—at 20s. per ton. The collieries and merchants claim that they are covered in such cases by the "restricted output" clause in the contracts!

The only bright spot of the whole business is the healthy increase in the demand for electric radiators.

INDUSTRIAL ENGINEERING TRAINING

A PAPER on "Training for the Industrial Side of Engineering," by Mr. A. P. M. Fleming, was read at a meeting of the Manchester Local Section of the Institution of Electrical Engineers recently. The author remarked that in this country, while a great deal of attention has been paid to the training of the technically-educated man, comparatively little has been done, other than by individual employers, to provide the best possible training for youths who are to become skilled workmen. After suggesting that more could be done by elementary teachers in observing which boys were likely to be suited to skilled handicrafts, he emphasised the need for some form of pre-apprenticeship training, and outlined some of the general requirements of practical training. In most engineering works, he said, no special facilities were provided for practical training, and an apprentice had to pick up experience in a haphazard fashion, although there were notable exceptions. In some works instructors were employed to see to the progress of apprentices. In others a separate training shop was provided.

It was interesting to see what was being done in other countries. In Germany youth are permitted to leave school at the age of 14, but must continue with their education for about eight hours per week throughout the period of apprenticeship. In Munich separate classes are arranged for each trade, in which, apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors. In the larger industries in Northern Germany it is more usual for an apprentice school to be provided in each works, or collectively for several works. Apprenticeship in engineering trades extends over a period of four years, and at the end of this time an apprentice is required to present himself before a committee of experts who examine his knowledge of the trade, and if he is competent, award him a master certificate. In France there is no national scheme for the training of artisans, but in Paris and other centres evening and Sunday-morning classes afford opportunity for trade instruction, and there are certain day schools for the combined practical and trade instruction of young men who intend to become expert workmen or foremen. In Switzerland, continuation education embodying trade instruction is carried out on a plan similar to that in Germany. In the United States there is as yet no national scheme, although much has been done by individual employers in various industries. In companies such

as the Westinghouse and General Electric, most of the practical experience is gained in a special training shop.

In the British Westinghouse Co.'s training system, instruction averaging five hours per week is given during working hours to all "bound" apprentices, numbering altogether about 300, in a school situated in the works. The regular rate of wages is paid during the time spent in study, and the cost of books, &c., is borne by the firm. The teaching is done by members of the firm's staff. Each year about 10 apprentices are selected and sent for one whole day each week to the course for engineering apprentices at the Manchester Municipal School of Technology. The cost of tuition is borne by the firm. In addition to the arrangements for training "trades" apprentices, the Company has for the past 12 years trained "engineering" apprentices according to certain well-defined courses.

Having secured suitable material for trades apprenticeship, the function of the subsequent training is two-fold. One is to select those who possess ability to profit by technical instruction, and to provide facilities for their advancement to positions where their capabilities may be fully utilised. The other is to train youths lacking in such ability so as best to fulfil their function as workmen. In the efficient training of the latter two requirements must be provided—manual experience and trade instruction. In regard to manual instruction a separate training shop in a works offers many advantages; and, failing this, a special apprentice instructor. These means are, however, not universally applicable, and in their absence it is necessary for each employer to take steps to ensure that the staff give personal attention to the training of the apprentices under their charge. In most engineering works such attention is almost entirely lacking.

With regard to trade instruction, the author considered that the evening technical classes available in most industrial centres were quite unsuitable. Such education should be made directly applicable to the trades of the district, and apprentices should be compelled by their employers to attend classes for suitable instruction, which should preferably be arranged during the daytime. He thought that the apprenticeschool method of training offered many advantages, and should not be impracticable even in small works. In this connection, a series of handbooks dealing with instruction for apprentices in each of the engineering trades would be of value and would serve to keep instruction throughout the industry of the same character. As regard "engineering" apprentices, it is not so important that the training be arranged on such uniform lines on account of the widely differing range of experience that different firms have to offer. Attention was also directed in the Paper to the value of scientifically-trained men in works organisation, and to the fact that except in isolated cases the technical colleges have neglected to give attention to this field of employment.

THE I.M.E.A. DEVELOPMENT COMMITTEE

THE following is a complete list of the members of this Committee, including those co-opted at recent meetings:—

Representing the I.M.E.A.: S. E. Fedden (Sheffield) [Chairman], S. T. Allen (Wolverhampton), F. Ayton (Ipswich), A. S. Blackman (Sunderland), R. A. Chattock (Birmingham), A. C. Cramb (Croydon), Coun. Crowther (Sheffield), J. E. Edgecome (Kingston), Ald. Ellaway (Birmingham), F. M. Long (Norwich), H. Richardson (Dundee), Ald. Pearson (Bristol), H. F. Proctor (Bristol), T. Roles (Bradford), A. H. Seabrook (Marylebone), Ald. J. Smith (Barrow), W. A. Vignoles (Grimsby), G. Wilkinson (Harrogate), J. W. Beauchamp (West Ham) [Acting Hon. Sec.].

Representing the A.M.E.B. (Greater London): W. C. P. Tapper (Stepney).

Representing the B.E.A.M.A.: R. J. Ireland (British Thomson-Houston Co.), G. Maurice (General Electric Co.), H. C. Siddeley (Lancashire Dynamo Co.), D. N. Dunlop (Sec., B.E.A.M.A.).

Representing Electrical Contractors' Association: L. G. Tate (Sec.).

Representing Cable Makers' Association: L. B. Atkinson (W. T. Glover & Co., Ltd.).

Representing Association of Electrical Power Cos.: W. A. Chamien, A. de Turckheim (Sec.).

Representing British Electrical Federation: W. L. Madgen.

Representing Society for Electrical Development, U.S.A.: F. W. Wilcox.

Sub-committees have been appointed to deal with the following matters: *Publicity*, to be worked from London district; Sec., A. C. Cramb (Croydon); *Electrical Installations*, to be worked from the Bradford district; Sec., T. Roles (Bradford); and *Domestic Appliances*, to be worked from the Birmingham district; Sec., S. T. Allen (Wolverhampton).

Copper Difficulties in Switzerland.—Owing to the difficulty of obtaining copper, the Swiss electricity works have formed an association for the common purchase of copper.

DRAWN WIRE LAMP FILAMENTS

Compulsory Licence Applied for

THE hearing of the application by the Robin Electric Lamp Co., Ltd., for the grant of compulsory licences under several patents for drawing metal filaments, owned by the B.T.-H. and Siemens companies, terminated on Wednesday, last week, in a somewhat unexpected manner. At the conclusion of the evidence for the petitioner, counsel on both sides were asked to address the Court, without evidence being called for the respondents, and on the conclusion of their speeches (after we had gone to press), Mr. Justice Warrington intimated that he would consider the case.

After the evidence for the plaintiffs, published in our last issue, the following witnesses were called:—

Mr. L. J. Simon, a consulting engineer concerned with theatrical installations, said that he had to deal with something like 30,000 lamps per annum, none of which, however, were Association lamps. He admitted that he had difficulty in getting customers to buy non-Association lamps even at 6d. per lamp less, on account of the reputation of the Association lamps, due, he said, to the advertisement schemes of the Association firms. So far as the Robin double-filament lamp was concerned, he would not be prepared to pay more than an extra 1½d. per lamp over the prices for single filament lamps, as he believed that by the time one filament went through age, the bulbs would be comparatively black, and the efficiency of the second filament would not be anything like that of the first.

Mr. T. A. Rose (recalled) said that the American General Electric Co. sold drawn tungsten wire at 5 dollars per 1,000 ft. to licensed companies.

Mr. M. A. Adam was examined at some length with regard to the patents in question in order to explain his opinion that the difference in manufacture between a carbon and a drawn wire metal filament lamp should not necessitate the prices being so different as 6d. and 2s. 8d. He said that he did not know of any country outside the United Kingdom where the price of drawn-wire lamps was so high as in this country, and thought that this higher price was largely due to the advertising power of the people who have the lamp in hand.

A copy of the licence granted to the Ediswan Company under 19 patents (including the drawn-wire patents) by the B.T.-H., Siemens, and Osram Companies was produced, and it was pointed out that the agreed royalty was 10 per cent. of the net selling price for lamps to be used in the United Kingdom and 5 per cent. on lamps for export. Allowing 30 per cent. as trade discount, off the list price of 2s. 8d., and taking 10 per cent. of the net price, gave a royalty of 2½d., which in witness's opinion would be in conformity with the general principles as regards scale of royalties.

In cross-examination the witness admitted that he was not in the lamp trade, and that he had never seen a tungsten lamp made, although he was familiar with all the processes "on paper."

Mr. George Cave, K.C., M.P., at the Judge's suggestion, then summed up the case on behalf of the petitioners, and Mr. A. J. Walter, K.C., Mr. J. Hunter Gray, and Mr. H. A. Colefax, K.C., addressed his lordship on behalf of the respondents, after which Mr. W. R. Bousfield, K.C., replied for the petitioners, and the Judge intimated that he would consider the case as stated above.

THE ELECTRICAL CONTRACTOR AND HIS "RIGHTS"

M R. T. S. BUCKLEY, Secretary of the Oldham Chamber of Trade, has written us stating that the article under this heading in our issue of Feb. 25th does not correctly represent the relationship between the Oldham Corporation and the local contractors who are members of the Oldham Chamber of Trade. This relationship, he says, is of a most amicable character. The contractors now keep a stock of all sizes of motors from ¼ h.p. to 10 h.p., and when customers apply to the Corporation, the officials point out to them that they can obtain motors from the contractors, and direct their attention to the list of them which hangs near the counter. Since this arrangement came into operation, the motors supplied through the Corporation have steadily diminished until last year less than a dozen were so supplied by them, and the Corporation only supply them in cases where the contractor cannot agree with the would-be customer. There are some people, he adds, who are so particular that they think only a Corporation can supply such apparatus. With regard to the hiring of cookers, heaters, &c., he continues, when the original arrangements were made to do this the price of current was 2d. per unit, and no business could be done. Within the last few months, however, the Corporation has reduced the price to 1d. per unit, and have asked the contractors if they would undertake the hiring of this apparatus, which they willingly promised to try and arrange for, but find that the Manufacturers' Associa-

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only very briefly to the deputation, as he had another deputation waiting to see him upon a different subject. He referred to the difficulty of obtaining railway trucks, promised to give his best consideration to the facts placed before him, and said that he would be pleased to receive any further suggestions that might be put forward.

Before Mr. Runciman retired, Mr. Barge reminded him that several of the electricity works required coal to enable them to supply electrical energy to works which were engaged in executing Government contracts.

The arguments put forward by the deputation and the speeches made, unfortunately did not suggest any definite practical remedies which can be applied immediately. Energetic Government intervention is needed in two directions. In the first place, the carrying out of contracts made since the outbreak of the war should be insisted upon, and, in the second place, change in the destination of the coal before it reaches the original purchaser must be prevented. A step in the latter direction has already been taken by the Railway Executive Committee, who will now not accept transfers of coal, and have insisted since March 1st that all wagons must be labelled direct from the colliery to the consumer.

At a certain time last November, the supply of coal produced from the pits exceeded the demand, prices were exceptionally low, many users took advantage of the opportunity for ordering, and, in consequence, stocks accumulated at the railway sidings and yards. Then came the shortage, due to the diminished railway facilities, and wagon hire rose from the usual 9d. a ton to 2s. and even 3s. per ton. The coal factors, faced with the shortage, could not resist the temptation of raising prices and transferring coal on order under contracts to other customers who were ready to pay these higher prices. We know of one case in which a contract was entered into for coal last November at 10s. 9d. per ton; deliveries under this contract are already over 2,000 tons in arrear, and the works which had ordered it has actually been obliged to purchase coal—perhaps even its own coal—at 20s. per ton. The collieries and merchants claim that they are covered in such cases by the "restricted output" clause in the contracts!

The only bright spot of the whole business is the healthy increase in the demand for electric radiators.

INDUSTRIAL ENGINEERING TRAINING

A PAPER on "Training for the Industrial Side of Engineering," by Mr. A. P. M. Fleming, was read at a meeting of the Manchester Local Section of the Institution of Electrical Engineers recently. The author remarked that in this country, while a great deal of attention has been paid to the training of the technically-educated man, comparatively little has been done, other than by individual employers, to provide the best possible training for youths who are to become skilled workmen. After suggesting that more could be done by elementary teachers in observing which boys were likely to be suited to skilled handicrafts, he emphasised the need for some form of pre-apprenticeship training, and outlined some of the general requirements of practical training. In most engineering works, he said, no special facilities were provided for practical training, and an apprentice had to pick up experience in a haphazard fashion, although there were notable exceptions. In some works instructors were employed to see to the progress of apprentices. In others a separate training shop was provided.

It was interesting to see what was being done in other countries. In Germany youth are permitted to leave school at the age of 14, but must continue with their education for about eight hours per week throughout the period of apprenticeship. In Munich separate classes are arranged for each trade, in which, apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors. In the larger industries in Northern Germany it is more usual for an apprentice school to be provided in each works, or collectively for several works. Apprenticeship in engineering trades extends over a period of four years, and at the end of this time an apprentice is required to present himself before a committee of experts who examine his knowledge of the trade, and if he is competent, award him a master certificate. In France there is no national scheme for the training of artisans, but in Paris and other centres evening and Sunday-morning classes afford opportunity for trade instruction, and there are certain day schools for the combined practical and trade instruction of young men who intend to become expert workmen or foremen. In Switzerland, continuation education embodying trade instruction is carried out on a plan similar to that in Germany. In the United States there is as yet no national scheme, although much has been done by individual employers in various industries. In companies such

as the Westinghouse and General Electric, most of the practical experience is gained in a special training shop.

In the British Westinghouse Co.'s training system, instruction averaging five hours per week is given during working hours to all "bound" apprentices, numbering altogether about 300, in a school situated in the works. The regular rate of wages is paid during the time spent in study, and the cost of books, &c., is borne by the firm. The teaching is done by members of the firm's staff. Each year about 10 apprentices are selected and sent for one whole day each week to the course for engineering apprentices at the Manchester Municipal School of Technology. The cost of tuition is borne by the firm. In addition to the arrangements for training "trades" apprentices, the Company has for the past 12 years trained "engineering" apprentices according to certain well-defined courses.

Having secured suitable material for trades apprenticeship, the function of the subsequent training is two-fold. One is to select those who possess ability to profit by technical instruction, and to provide facilities for their advancement to positions where their capabilities may be fully utilised. The other is to train youths lacking in such ability so as best to fulfil their function as workmen. In the efficient training of the latter two requirements must be provided—manual experience and trade instruction. In regard to manual instruction a separate training shop in a works offers many advantages; and, failing this, a special apprentice instructor. These means are, however, not universally applicable, and in their absence it is necessary for each employer to take steps to ensure that the staff give personal attention to the training of the apprentices under their charge. In most engineering works such attention is almost entirely lacking.

With regard to trade instruction, the author considered that the evening technical classes available in most industrial centres were quite unsuitable. Such education should be made directly applicable to the trades of the district, and apprentices should be compelled by their employers to attend classes for suitable instruction, which should preferably be arranged during the daytime. He thought that the apprentices-school method of training offered many advantages, and should not be impracticable even in small works. In this connection, a series of handbooks dealing with instruction for apprentices in each of the engineering trades would be of value and would serve to keep instruction throughout the industry of the same character. As regard "engineering" apprentices, it is not so important that the training be arranged on such uniform lines on account of the widely differing range of experience that different firms have to offer. Attention was also directed in the Paper to the value of scientifically-trained men in works organisation, and to the fact that except in isolated cases the technical colleges have neglected to give attention to this field of employment.

THE I.M.E.A. DEVELOPMENT COMMITTEE

THE following is a complete list of the members of this Committee, including those co-opted at recent meetings:—

Representing the I.M.E.A.: S. E. Fedden (Sheffield) [Chairman], S. T. Allen (Wolverhampton), F. Ayton (Ipswich), A. S. Blackman (Sunderland), R. A. Chattock (Birmingham), A. C. Cramb (Croydon), Coun. Crowther (Sheffield), J. E. Edgcome (Kingston), Ald. Ellaway (Birmingham), F. M. Long (Norwich), H. Richardson (Dundee), Ald. Pearson (Bristol), H. F. Proctor (Bristol), T. Roles (Bradford), A. H. Seabrook (Marylebone), Ald. J. Smith (Barrow), W. A. Vignoles (Grimsby), G. Wilkinson (Harrogate), J. W. Beauchamp (West Ham) [Acting Hon. Sec.].

Representing the A.M.E. (Greater London): W. C. P. Tapper (Stepney).

Representing the B.E.A.M.A.: R. J. Ireland (British Thomson-Houston Co.), G. Maurice (General Electric Co.), H. C. Siddeley (Lancashire Dynamo Co.), D. N. Dunlop (Sec., B.E.A.M.A.).

Representing Electrical Contractors' Association: L. G. Tate (Sec.).

Representing Cable Makers' Association: L. B. Atkinson (W. T. Glover & Co., Ltd.).

Representing Association of Electrical Power Cos.: W. A. Chamen, A. de Turckheim (Sec.).

Representing British Electrical Federation: W. L. Madgen.

Representing Society for Electrical Development, U.S.A.: F. W. Wilcox.

Sub-committees have been appointed to deal with the following matters: *Publicity*, to be worked from London district; Sec., A. C. Cramb (Croydon); *Electrical Installations*, to be worked from the Bradford district; Sec., T. Roles (Bradford); and *Domestic Appliances*, to be worked from the Birmingham district; Sec., S. T. Allen (Wolverhampton).

Copper Difficulties in Switzerland.—Owing to the difficulty of obtaining copper, the Swiss electricity works have formed an association for the common purchase of copper.

DRAWN WIRE LAMP FILAMENTS Compulsory Licence Applied for

THE hearing of the application by the Robin Electric Lamp Co., Ltd., for the grant of compulsory licences under several patents for drawing metal filaments, owned by the B.T.-H. and Siemens companies, terminated on Wednesday, last week, in a somewhat unexpected manner. At the conclusion of the evidence for the petitioner, counsel on both sides were asked to address the Court, without evidence being called for the respondents, and on the conclusion of their speeches (after we had gone to press), Mr. Justice Warrington intimated that he would consider the case.

After the evidence for the plaintiffs, published in our last issue, the following witnesses were called:—

Mr. L. J. Simon, a consulting engineer concerned with theatrical installations, said that he had to deal with something like 30,000 lamps per annum, none of which, however, were Association lamps. He admitted that he had difficulty in getting customers to buy non-Association lamps even at 6d. per lamp less, on account of the reputation of the Association lamps, due, he said, to the advertisement schemes of the Association firms. So far as the Robin double-filament lamp was concerned, he would not be prepared to pay more than an extra 1½d. per lamp over the prices for single filament lamps, as he believed that by the time one filament went through age, the bulbs would be comparatively black, and the efficiency of the second filament would not be anything like that of the first.

Mr. T. A. Rose (recalled) said that the American General Electric Co. sold drawn tungsten wire at 5 dollars per 1,000 ft. to licensed companies.

Mr. M. A. Adam was examined at some length with regard to the patents in question in order to explain his opinion that the difference in manufacture between a carbon and a drawn wire metal filament lamp should not necessitate the prices being so different as 6d. and 2s. 8d. He said that he did not know of any country outside the United Kingdom where the price of drawn-wire lamps was so high as in this country, and thought that this higher price was largely due to the advertising power of the people who have the lamp in hand.

A copy of the licence granted to the Ediswan Company under 19 patents (including the drawn-wire patents) by the B.T.-H., Siemens, and Osram Companies was produced, and it was pointed out that the agreed royalty was 10 per cent. of the net selling price for lamps to be used in the United Kingdom and 5 per cent. on lamps for export. Allowing 30 per cent. as trade discount, off the list price of 2s. 8d., and taking 10 per cent. of the net price, gave a royalty of 2½d., which in witness's opinion would be in conformity with the general principles as regards scale of royalties.

In cross-examination the witness admitted that he was not in the lamp trade, and that he had never seen a tungsten lamp made, although he was familiar with all the processes "on paper."

Mr. George Cave, K.C., M.P., at the Judge's suggestion, then summed up the case on behalf of the petitioners, and Mr. A. J. Walter, K.C., Mr. J. Hunter Gray, and Mr. H. A. Colefax, K.C., addressed his lordship on behalf of the respondents, after which Mr. W. R. Bousfield, K.C., replied for the petitioners, and the Judge intimated that he would consider the case as stated above.

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QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive reply in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,433.

I am in charge of an accumulator battery. One cell gives me plenty of trouble. Its peculiarity is that the specific gravity falls during charging, and recovers during the discharge. The plates are in good condition, and have a clearance of 6 in. between lower edges of plates and bottom of cell, which is a teak lead lined tank. There are no shorts in the cell, and the sediment was taken out to be sure that there was no fouling due to it. The battery is not yet three years old. The sulphuric acid was 1.840° S.G. before mixing with the distilled water, and when mixed the electrolyte was 1.180 S.G. There is also no temperature variation in the battery room during the charge. What is the probable cause of the trouble?—"H. C. P." (Hong Kong).

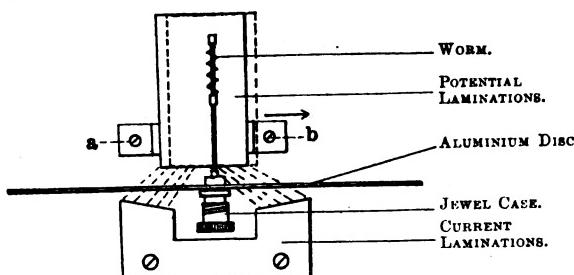
(Answers must be received not later than first post Thursday, March 18th.)

ANSWERS TO No. 1,431.

I am in a sub-station where 11,500 volts, 25 cycles is transformed down to 550 for tramway service; on the transformer panel there is a watt-hour meter, a power-factor meter, and an ammeter. The voltage is transformed down to 110 volts for those instruments through potential transformers. The watt-hour meter will work all right on full load, but when the load is light it starts to run backwards. Why is this? Please also state if a 50-cycle power-factor meter will work satisfactorily on a 25-cycle circuit.—"W. M."

The first award (10s.) is given to "J. W. D." for the following reply :

As "W. M." states that the meter works all right on full load, it must be concluded that the connections are correct. The question does not state whether the discs rotate on shunt



DIAGRAMMATIC SKETCH WITH COILS OMITTED.

or not—that is, when only the potential coils are connected up. However, I will take it for granted that there is no shunt running, although this can be tested by disconnecting the current coils, leaving the potential coils connected. Then, if the discs rotate, which will be very slight, if at all, the position of the pole pieces will have to be re-set, thus altering the speed, and hence the calibration. After the shunt-running test has been carried out, disconnect the potential coils and apply approximately full load to the current coils, when it will probably be found that the discs will rotate in the wrong direction, this being called current-running, which will have the effect of causing the magnet discs to rotate backward at light load. The effect of the magnet

flux on a disc in such a case is shown by the accompanying sketch. As it is seen, the position of the current and potential poles are not in a straight line, consequently the flux is of greater density on one side than on the other, thus causing unequal eddy-currents in the disc, and hence rotation commences. To remedy this effect, slacken the screws (a) (b) which are supporting the potential pole-piece by means of brackets, and then move the laminations in the direction of the arrow to the position marked by dotted lines. It must be moved a little at a time, until there is no tendency of the disc to run. I assume the meter to be polyphase, consequently this test will be better carried out by having only one set of coils connected at a time, and making the necessary adjustments separately. Of course, if the laminations are short-circuiting, shunt-running or current-running may occur even when the potential and current coils are in a line. The movement of the poles alters the calibration of the meter, and will therefore require to be checked up, this adjustment being effected by the braking magnets.

A power-factor meter will not work correctly if connected to a supply of frequency to which the coils have not been wound, for although devices may be fitted to compensate for frequency changes, it would not have sufficient effect in such extreme cases. The reason is this : The action of the power-factor meter works on the principle of the rotating magnetic field system (not the pole-pieces). The pressure coils are pivoted, and rotate within the current coils. The magnetic flux produced by the potential coils is 90° behind the applied pressure. At unity power-factor the current is in phase with the pressure, and consequently the magnetic fields of the current coils rotate or coincide with those of the pressure coils. If an inductive load comes on, thus causing a lagging current, it follows that the magnetic field of the current coils will rotate at an angle slightly behind those produced by the pressure coils, the magnitude of this angle depending on the amount of phase displacement caused by the inductive load. Now as the pressure coils are wound for 50 cycles instead of for 25 cycles, there is a less number of turns in the former than on the latter, consequently the transformer E.M.F. will not be produced with the proper phase angle; hence an error occurs, due to the rotating magnetic fields not making the correct phase-displacement corresponding to different natures of loads.

The second award (5s.) is made to "OHM," who writes as follows :—

Full particulars of the system are not given in the question, but it is evident that the high-tension supply is three-phase three-wire, and therefore the meter complained of is an ordinary two-element induction meter, suitable for this class of service, operated from current and potential transformers. With an arrangement of this kind the current coil of element No. 1 is connected, for example, in Phase 1, with the potential winding between Phases 1 and 2, and element No. 2 in Phase 3, with the potential winding between Phases 3 and 2. If, therefore, the phase rotation is of the order 1, 2, 3, and the phase currents are lagging, then we get :—

Torque of element No. 1 is proportional to $C_1 V \cos(30 + \theta)$, and torque of element No. 2 is proportional to $C_2 V \cos(30 - \theta)$, where C_1 = current in Phase 1, C_2 = current in Phase 3, V = voltage between phases, and $\cos \theta$ = power factor.

It should be noted that as the power factor diminishes—corresponding to an increase in θ —the torque of element No. 2 will gradually increase to a maximum and then decrease, providing the current load does not alter. In the case of element No. 1, however, a reversal of the torque will occur when $\theta = 60^\circ$. In other words, when the power factor is 0.5, the torque due to element No. 1 will be zero, and furthermore for lower power factors the torque will reverse and the meter discs would therefore change their direction of rotation. This, of course, would only occur if element No. 2 was inoperative. As "W. M." has observed this effect when the load is light—that is, when the power factor is low—the evidence is fairly conclusive that element No. 2 is defective, due most probably to a break in the potential circuit. Regarding the last portion of the question, it can be assumed, as a general rule, that a power-factor indicator will give quite reliable indication on any frequency within the limits met with in practice. The reason is that the potential circuits of such an instrument are non-inductive—as in a wattmeter—so that the currents flowing through them are independent of the frequency.

QUESTION No. 1,429.

M. J. L. writes us as follows :—

"I would be very pleased if I may be allowed to ask 'C. S. B.' a question through your paper with regard to his reply to Question 1,429. In the first place I do not say that he is wrong, but there is one item which has interested me, and that is as follows : He says that when the stator switch is closed, the pressure induced in the rotor windings will be approx. 200 volts. I would be very pleased indeed if he could say how he came at the above figure, as I myself have always been under the impression that with the rotor standing still the currents and E.M.F.'s in the rotor would be considerable, as the cutting of the lines of force would now be at the greatest rate. Also in order that the rotor should generate full-load current with all the resistances in circuit, it is necessary that considerable E.M.F. should be generated in the rotor windings."

ANSWERS TO CORRESPONDENTS

T.C.C.—You will be able to obtain the information that you desire from the Secretary of the Institution of Electrical Engineers, Victoria Embankment, W., and the Secretary of the Association of Supervising Electricians, 14 Pulborough Road, Southfields, S.W.

C. VOGELEZANG.—The address that you ask for is Messrs. Chamberlain & Hookham, Ltd., 4 New Bartholomew Street, Birmingham.

ELECTRIC TRACTION NOTES

The corrosion of water and gas mains by tramway return currents, and means for providing against other electrical disturbances, were dealt with by Mr. H. E. Yerbury in a Paper read on Feb. 23rd before the Institution of Civil Engineers. The author discussed various theories of corrosion, and said that white cast-iron was less susceptible to corrosion than pig-iron, as it contained less graphitic carbon and silicon. Concrete conducted electrolytically and electrolysis was attributed in certain cases to impurities, such as calcium sulphate, added to retard setting. The measures used to limit the potential difference between the track and the pipes were discussed and the negative booster system explained. The ideal system was for the boosted and unboosted return conductors to be kept at the same potential, but if the potential of the rails, at some point where a negative boosted conductor is bonded, is lowered to an abnormal degree, it follows that pipes carrying a leakage current are invited to give up their charge, as the difference of potential is thereby increased. This fact is appreciated by the Board of Trade, as one regulation stipulates that the direction of the current should be reversed by interposing one Leclanché cell (1·48 volt) if the current is from the pipe to the return, whereas up to 4·4 volts are allowed where the direction of the current is from the uninsulated return to any pipe in the vicinity. As current-density and duration of current are the most important factors in connection with electrolytic action on pipes, potential readings are somewhat misleading, as it is now well known that where a comparatively high difference of potential exists there is, as a rule, less injurious current passing. This is largely attributable to the counter electromotive force of polarisation. The Board of Trade regulations in respect to leakage currents can easily be complied with, and are absolutely effective in safeguarding the property of other authorities. As 650 volts are allowed as a generating or transforming pressure, in the author's opinion up to 600 volts could be allowed between overhead conductors and earth, as 10 per cent. is often the maximum drop on a tramway system. This increase of voltage would reduce the cost of feeders and also the heavy currents now dealt with. It was important that metallic connections to the rails, such as bonds from tramway-poles and feeder-pillars, should be as few as possible, and all pipes should be kept at least 2 ft. from the track. All rail-joints should be tested periodically. Where joints are welded, a copper bond is recommended as a precautionary measure in case of a high resistance being set up by a badly welded joint, which resistance in course of time would be intensified by additional oxidation. The latter part of the Paper dealt briefly with some aspects of the question of interference of single-phase traction currents with telephone and telegraph circuits.

In a paper read recently before the Institution of Railway Signal Engineers by Mr. A. F. Bound, the author reviewed some of the changes occurring in railway conditions, and contended that the time had come when the ordinary block system was not sufficient protection, and that, in view of the fact that we were now passing through a period in which accidents were due not to failure of the machine but of the human element, we must use something more in the direction of automatic signalling. He outlined a system of track-circuit signalling, and showed how he would propose to introduce this gradually in several styles until a complete system of automatic protection was reached.

It is anticipated that the electrification of the North-Eastern line between Shildon and Newport will be completed this summer.

Notwithstanding an increase in expenditure last year of £7,000 and a decrease in revenue, the Hull Corporation Tramways Committee has decided to grant £10,000 for relief of rates. This is £3,000 more than in the previous twelve months.

At the annual meeting of the London Brighton & South Coast Railway Co. last week, only a brief reference was made to the electric traction scheme, and this took the form of pointing out that the electrical services running in the districts between Victoria and London Bridge, Victoria and Crystal Palace, and London Bridge and Crystal Palace in particular have shown marked expansion. No reference was made to the position of the Company in regard to the electrical extensions now in hand, owing to the war and to the fact that the main contracts were placed in German hands.

The controversy with regard to the advisability of the Bristol Corporation purchasing the Bristol Tramways & Carriage Co.'s undertaking, as it has powers to do in an Act obtained last session, still continues to excite much interest in Bristol. The Corporation experts have estimated that the undertaking is worth £670,000, but Sir George White, the Chairman of the Company, says that the claim will be something like £2,000,000. The Special Committee of the Corporation which is dealing with the matter has invited the directors of the Company to a conference with a view to arriving at an amicable arrangement.

At the annual meeting of the North London Railway Co. last week, reference was made to the delay in the electrification scheme in conjunction with the London & North Western Railway Co. due to the war. It had been hoped to complete this work by the spring of this year, but this is now quite beyond the bounds of possibility. A similar state of affairs exists with regard to the London & North Western Railway Co., but it is hoped that by the end of the present year to have the new service between Broad Street, Kew, and Richmond in working order. The sum of £249,716 has been advanced to the London Electric Co. as part of the £1,000,000 which it has been agreed to lend them in connection with the new extensions from Paddington to Queen's Park.

Owing to difficulty in obtaining supplies of tram rails from its English contractor, the Birmingham Tramways Committee asks sanction to purchase 2,000 tons of rails and fish-plates from the Lorain Steel Co., U.S.A.

The British Association.—It is announced that the Council has decided to hold the annual meeting of the Association next September as previously arranged. It is felt, however, that it would be inexpedient, in present conditions, to carry out the usual social arrangements in connection with the meeting, and in order to continue the long continuity, the meetings will be restricted to the purely scientific functions. The meeting is to be at Manchester.

The Firing of Mines.—The second part of the discussion on the applications of electricity in warfare at the meeting of the Students' Section of the Institution of Electrical Engineers last week, dealing with the firing of mines and explosives, was opened by Mr. S. Killingback, who said that the advantages of electrical means for firing mines might be briefly summarised as : Convenience, greater reliability, remote control, and simultaneous firing of several charges. Mines and explosives may be fired either by accumulators or by the portable hand-operated service dynamo. The standard types of electric fuses and detonators require a current of about 0·8 ampere for fusing. Mr. Emtage asked why platinum-iridium wires were employed in the standard service fuses, and expressed an opinion that trinitrotoluene was superseding guncotton and gunpowder in the fuses. Mr. Heslop referred to the fact that electrical firing of mines was not employed in the Russo-Japanese war, and that the chief field for electrical firing of mines was for harbour protection as reliable connections and cables could then be laid. The ordinary time fuses are generally satisfactory in other cases. The Chairman (Mr. Duddell) referred to the exploder captured from the Boers (which was of German make even at that time), that was now preserved in the Institution Library. The third portion of the discussion on "Searchlights and Projectors" will be opened by Mr. E. L. M. Emtage on March 31st. The first part is referred to under "Telephony and Telegraphy."

Western Local Section of the Institution of Electrical Engineers.—The following are the Council's nominations for the vacancies that will occur among the officers and committee:—Chairman, Mr. D. E. Roberts, Cardiff. Vice-Chairman, Prof. D. Robertson, Bristol. Nominations to fill five places on the Committee:—Messrs. A. J. Abraham (Aberdare), M. T. Evans (Bristol), R. H. Fletcher (Llanishen), W. W. Hughes (Swansea), A. C. McWhirter (Cardiff), W. G. Heath (Plymouth), C. W. Salt (Torquay), A. L. Stephens (Bristol). Any other nominations must be proposed and seconded, and an intimation in writing from those nominated that they will be willing to serve if elected, must be received not later than March 15th.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 4th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,959/14. Electric Traction. B.T.-H. Co. (*G.E. Co., U.S.A.*). A method of controlling series motors supplied with pulsating unidirectional current, such as can be derived from a mercury vapour rectifier, in which a non-inductive resistance in parallel with the field winding diverts the alternating component of the current. (One figure.)

3,596/14. Brush-holders. B.T.-H. Co. and F. P. WHITAKER. A box-type brush-holder having a spring arranged to exert pressure on the brush in a radial and tangential direction, so that the brush is pressed against the rear side of the pocket at the top and the front side of the pocket at the bottom, and is thus held steady in its natural position. (One figure.)

4,432/14. Heaters. H. HIRST and C. H. ARCHER. A heating element comprising a rod of insulating and refractory material with the resistance wire wound in a deep helical groove, and connected to end collars. A metal strengthening rod passes through an axial hole in the refractory rod. (Two figures.)

7,440/14. Light Control. C. J. TURNER. Apparatus for automatic control of lighting circuits by the variation of resistance of selenium with illumination. The selenium cell is connected in series with an electro-magnetically actuated mercury break switch.

9,638/14. Telephone Receiver. E. C. R. MARKS (*Electrical Experiment Co., New York*). A telephone receiver with a rigid diaphragm permitted to vibrate as a whole by being mounted between resilient rubber tube rings. Its movement is aperiodic, and a fine tone is obtained. (Two figures.)

22,586/14. Fixation of Nitrogen. Soc. GÉNÉRALE DE NITRURES. Bauxite and similar mixture is reduced in the electric furnace in presence of carbon, and further iron is added. The ferro-aluminium thus produced is finely divided, mixed with porous material, and exposed to the air, when the temperature spontaneously rises till it obtains a value sufficient for the combination of the aluminium with the nitrogen to form a nitride.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. Co. (*G.E. Co.*) [Distribution] 3,831/14 and [Conductors] 4,235/14.

DYNAMOS, MOTORS, and TRANSFORMERS: MASON [Generator] 174/14.

Heating and Cooking: BERRY [Heating apparatus] 3,722/14.

Ignition: HUMBER, LTD., and COLE [Magnets] 1,940/14.

Switchgear, Fuses, and Fittings: HORTON [Switches] 5,431/14; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Cut-outs] 8,821/14; WILSON [Switches] 11,840/14; HENSELL [Fuses] 14,474/14.

Telephony and Telegraphy: GALLETI and MANGETTI [Discharges for producing oscillations] 2,739/14; SQUIER [Wireless telegraphy and telephony] 3,191/14; DE LANGE [Thermic telephone] 4,184 & 4,203/14; WESTERN ELECTRIC CO. (*Woodward for W.E. Co., U.S.A.*) [Automatic telephones] 4,489/14; LAMB [Antiseptic protectors for telephones] 15,598/14.

Traction: A.G., BROWN, BOVERI & CIE [Reversing and braking A.C. motors] 28,933/13; ASPINALL [Electric railway system] 901/14.

Miscellaneous: THORNTON [Illuminated signs] 3,953/14; SCOTT and MEDWAY [Electric Lifts] 4,236/14; SCOTT [Telemotors] 4,323/14; RAILING, PEACOCK and HUTCHINSON [Electrically worked presses] 4,735/14; CHAPMAN [Long-stroke electromagnets] 4,815/14; LUNDBERG, LUNDBERG, LUNDBERG and PEGG [Electric supply installations] 11,165/14; LINDSAY [Electric primers] 18,810/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Incandescent Lamps: JULIUS PINTSCH A.C. [Filament supports] 17,022/14.

Traction: Soc. ANON. DES ÉTABLISSEMENTS L. BLERIOT [Car lighting] 882/15.

Miscellaneous: GARLITZ [Magnetic skelp charging machine] 1,928/15; CLAUDE [Neon vacuum tubes] 2,020/15.

Amendment Made

3,655/13. Car Lighting and Engine Starting. C. F. KETTERING. This specification, which describes a combined lighting generator and engine-starting motor, has been amended by the addition of a reference to No. 18,444/12 of W. E. Lake (*J.B.M. ELECTRIC Co., NEW YORK*).

Application for Suspension

28,412/12. Sparking Plugs. G. RUPRECHT. An application by H. van Raden and W. G. Davis, trading as Davis & Walker, for the suspension of this patent, will be heard on March 11th. The specification describes a plug with the body made in two pieces, one of which is a nipple which screws into the other and forces a collar on the insulating sleeve against an internal shoulder on the nut forming the main body of the plug. The nipple forms the portion which screws into the cylinder.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:-

4,597/01. Maximum Demand Indicator. A. WRIGHT and REASON MANUFACTURING CO. Improvements in details of construction of the well-known Wright maximum demand indicator.

4,760/01. Temperature Compensation. A. CAMPBELL. A method of compensation of ammeters, voltmeters, &c., for temperature depending on the use of a Wheatstone bridge arrangement with arms of different temperature coefficients.

5,496/01. Meters: E. BATAULT. Numerous improvements in induction meters for A.C.

5,589/01. Telegraphy. A. MUIRHEAD. Details of a method of retransmission of messages received over submarine cables.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: J. S. HIGHFIELD [Wiring systems] 24,533/08.

DYNAMOS, MOTORS, and TRANSFORMERS: A. J. BOULT (*Felten & Guilleaume Lahmeyerwerke A.G.*) [Motor control] 27,026/09.

Electrochemistry and Electrometallurgy: A. H. HELFENSTEIN [Electric furnaces] 26,845/09.

Instruments and Meters: W. E. SUMPNER [A.C. instruments] 24,605/04.

Storage Batteries: E. W. JUNGNER [Construction of battery plates] 25,095/04.

Telephony and Telegraphy: A. G. BLOXAM [Tubular metal brackets for telegraph poles] 25,047/03.

Traction: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Current collecting shoes] 25,863/06.

Miscellaneous: J. A. L. PEALING [Magnetic drill] 26,845/08; J. E. PRESTON [Primary batteries] 26,683/09.

American Submarines.—The American papers announce that the U.S. Navy is building a submarine equipped with Edison batteries. Orders have also been given to the Electric Boat Co. for a submarine of 1,000 tons displacement, which will have battery power enabling it to run under water for more than 24 hours. Its radius of action is to be 3,000 miles, its surface speed 20 knots, and its submerged speed 11 knots. Seven smaller coast defence submarines are also reported to be on order.

The German and Austrian Electrical Industry.—An article in the Vienna *Neue Freie Presse* of Feb. 12th, which we have received via Switzerland, states that the Austrian electrical manufacturing firms have "recently" taken up the manufacture of shells and other material for the army; electrical work is not very active. It is stated that the same applies to Germany. The Berlin Electricity Supply Company has been obliged to reduce its dividend by 4 per cent, but, on the other hand, the Vienna municipal electricity works had an increased output for the past year. The electricity works in places of medium and small size, and also some of the electric power works, however, are experiencing increased difficulty in obtaining fuel, and a law limiting the supply of both lubricating and fuel oil is also affecting them. Lamp manufacturers apparently are not finding it easy to get some of their raw materials, owing to an enactment with regard to the consumption and requisition of metals applying to tungsten, molybdenum, and thorium. Large schemes, such as the electrification of railways, and an extension of Vienna electric railway system have, needless to say, been postponed.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

At a meeting of the Students' Section of the Institution of Electrical Engineers last week, a series of discussions on the application of electrical engineering to warfare was commenced, with one on "communications" opened by Mr. P. R. Coursey, who pointed out how fire and flashlight signalling has long been superseded by electrical methods, which enabled great strides to be made towards the ideals of speed and secrecy. He referred to the uses of telegraphy in the Boer and Russo-Japanese wars, in the latter of which wireless telegraphy was first used in the field. In the present war, he said, five main types of electrical apparatus for communication purposes were being employed by the conflicting armies: wireless telegraph; Wheatstone automatic telegraph; Morse sounder; vibrator tele-

graph, and field telephone; the last two being sometimes combined into one apparatus. Mr. Coursey gave brief descriptions and illustrations of the most general types of military apparatus, and compared their uses and relative advantages. Mr. Smith Rose referred to the difficulties of reception of wireless messages on aeroplanes on account of the noise of the engine. Mr. Emtage suggested that it might be possible to detect the approach of Zeppelins and submarines by picking up their ignition sparks by wireless receivers; and described the pneumatic headpiece "shock-absorbers" worn by airmen, which, at the same time served to deaden the noises due to the engine, and facilitated wireless reception. A number of questions were asked, and the chairman (Mr. Duddell) contrasted the modern means of communication with those employed in wars 100 years ago and more, and the great objection, he said, to modern methods of communication is that they all give too much information to the enemy, and in many cases despatch riders were proving to be a more secret means of communicating intelligence. A note on a further section of the discussion on a different branch of the subject will be found on another page.

"ELECTRICAL ENGINEERING" TRADE SECTION

ELECTRICAL TRADE WITH CANADA

Special Interview with H.M. Trade Commissioner

MR. HAMILTON WICKES, H.M. Trade Commissioner for Canada, is in London for about a fortnight, and kindly granted our representative an interview. We were naturally anxious to learn Mr. Wickes's opinion as to the position and prospects of the electrical engineering industry in the Dominion, and he gave us some very interesting information with regard to this and as to the methods employed by our most successful competitors there. The competition for the Canadian electrical trade is with the United States, not with Germany—strange to say, although the effect of the war was mentioned in our conversation (as will be seen later in this article), the name Germany did not pass Mr. Wickes's lips during the long half-hour we spent with him.

The bulk of Canada's electrical requirements is at present probably supplied by the Canadian General Electric Co., which works in close connection with the American General Electric Co., and by the American Westinghouse Co. Both have works in Canada, and, in fact, the Canadian General Electric Co. is now entirely Canadian-owned; it works, however, in close connection with the General Electric Co. of Schenectady, and its methods are "ultra-American."

It is essential for any firms who desire to open up good business in Canada to make a thorough study of the requirements there; it is not merely sufficient to send over a representative who does not know the country, and to offer plant and apparatus of standard English patterns, relying merely on the reputation of the firm and the quality and price of the goods being "right." Canada, it must be remembered, has been largely educated up to American standard designs and patterns. Low price is not so important as to supply exactly what is wanted, and comparatively trifling departures from what is required may lose repeat orders.

The successful salesmen of the Canadian and American electrical firms are largely drawn from the McGill University and other colleges. In the case of one firm, for instance, only graduates from such recognised colleges will be taken, and they are started at once with a salary of £70 to £100 a year to take a practical course at the company's works, where they also attend lectures. After that they are placed for a year in the district correspondence department at the head office, and are then sent out as correspondents in a district office, and gradually get in touch with customers. When they finally start life as salesmen, they know the details of the business thoroughly, have the enthusiasm of youth, and are thoroughly imbued with the idea that their's is the best, in fact, "the only" concern in the world. Firms at home, Mr. Wickes told us, appear to expect that, unless a large amount of business is obtained at once, it is no good proceeding further, whereas as much will depend on the personality and intelligence of their representative as upon

the firm itself, and it is necessary to choose the right man, to place full confidence in him, and to give him responsibility and time to develop business gradually. He must be capable, not only of getting orders, but of arranging all details, of giving instructions to headquarters, and not merely receiving them, and of carrying out contracts to final completion.

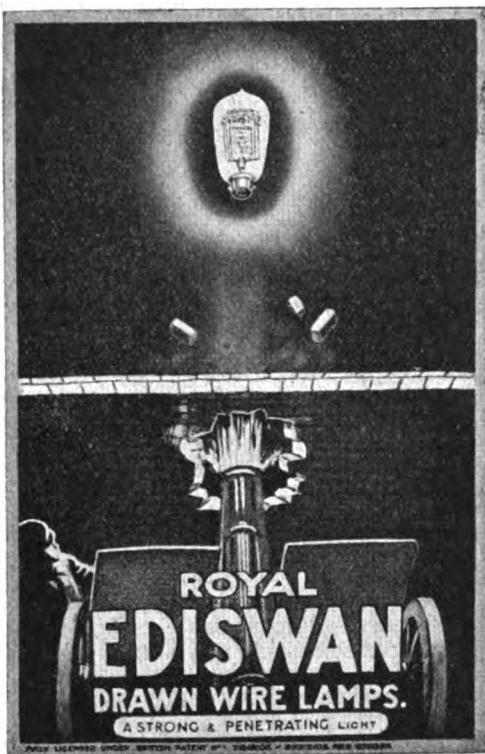
The "Underwriters' Laboratory" has been one of the difficulties in the way of placing English apparatus for house installation work on the Canadian market. The insurance companies in Canada have made joint cause with the American companies, and have agreed to accept only the standards approved and tested by the American Underwriters' Laboratories—of Chicago—and in conformity with the specifications of the American "National Electric Code." Last year, however, arrangements were made by which Messrs, Heap & Digby represent the Laboratories in London, and their examination of apparatus is accepted (see ELECTRICAL ENGINEERING of July 23rd, 1914, p. 417). It may be mentioned incidentally that it is not only wire, cable, and smaller accessories that come under the National Electric Code, but also generating and transforming plant, &c., if it is to be installed in houses.

The British fire insurance companies have, in this direction, missed a great opportunity for benefiting British trade. A very large proportion of the buildings in Canada are insured with British companies, and if they had insisted on British rules and standards instead of American, the position there would be very different. We wonder whether it is still not too late for the matter to be taken up in this light by the British Electrical and Allied Manufacturers Association.

Needless to say, before parting with Mr. Wickes, it was necessary to ask him the all-important question: What effect are the war conditions having upon electrical trade in Canada? Mr. Wickes's answer was unexpected. The war conditions are bringing money into Canada, and as a result a healthy permanent increase in trade may be confidently expected. Canada has received orders from Great Britain to the value of fifteen or sixteen million pounds sterling. We will not particularise as to the industries in which these orders are placed, but will merely point to the obvious result that the Dominion will be the richer for them. The result is that over 40 per cent. more ground is being cultivated in the prairie provinces, and given a fair crop, and the good prices which must prevail, an enormous amount of money will be flowing into Canada. Canada will be richer, and every industry, including the electrical industry, will receive considerable stimulus, as there will be money to spend. Mr. Wickes does not anticipate that the trade boom in Canada will be quite equal to that in 1911 and 1912—which, however, was followed by a serious reaction for eighteen months, owing to over-speculation in "real estate." But the English firms then mostly only came in towards the end of the prosperous period, and thus also experienced an undue share of the results of the reaction. This time they have an opportunity of taking the tide at the flood, and we will hope that it will "lead on to fortune."

AN EFFECTIVE LAMP ADVERTISEMENT

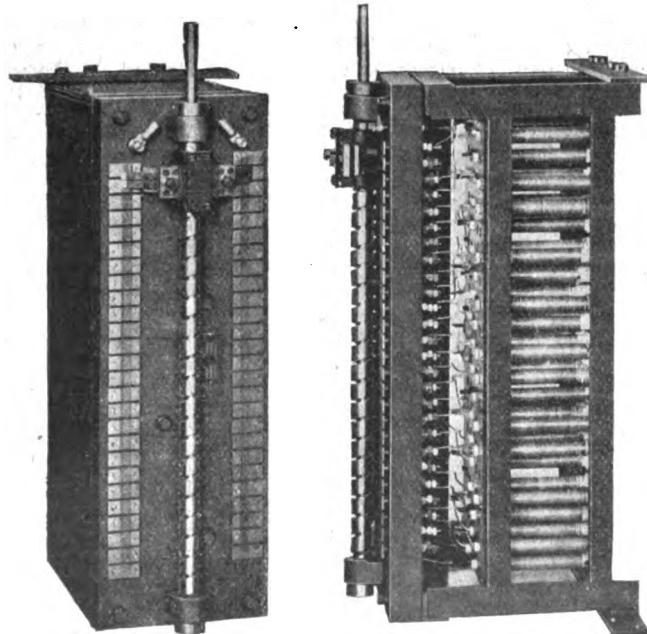
WE reproduce here the striking new poster design which appears on the cover of a neat little folding price-card of Royal Ediswan lamps and also figures on an order form



postcard which is being issued by the Edison & Swan United Electric Light Co. (Ponders End, Middlesex). These cards can be overprinted with contractors' names and addresses. The way in which the idea of a "strong and penetrating" light is expressed is very appropriate.

EXCITER FIELD REGULATORS

A PATTERN of exciter field rheostat of the rectangular type, somewhat similar to the main alternator field regulators described in ELECTRICAL ENGINEERING, Nov. 19th, p. 604, has been brought out by the General Electric Co.,



EXCITER FIELD REGULATOR FOR 3,000-kw. TURBO-ALTERNATOR.

Ltd. (67 Queen Victoria Street, E.C.). This regulator, which is shown in the accompanying illustrations, consists of two parallel lines of rectangular contacts mounted on a slate

base. The base is carried on a strong steel framework, on which is also mounted the resistance, composed of special resistance wire wound on asbestos tubes. These asbestos tubes are carried on steel supporting bars, which are bolted at both ends to the framework. The connections between the resistance wire and the contacts are solid, there being no loose wires. This follows on standard G.E.C. practice for all their regulators and starters. The regulator illustrated was one of a number constructed for controlling the shunt current of the exciter for a 3,000-kw. turbo-alternator.

A CHARGING APPARATUS FOR SMALL CELLS

A SIMPLE and convenient charging device for portable lamp cells has been put on the market by L. E. Wilson & Co. (10 Corporation Street, Manchester) for use in connection with the cells for their "Thomson" pocket accumulator lamp. This consists of a patent porcelain holder which can be screwed on the wall, preferably adjacent to a suitable switch, which should be replaced by a special duplex switch. This is arranged to turn on a lamp in the ordinary way, or connect the charging apparatus to the circuit with the lamp as a resistance in series. Thus the apparatus in no way interferes with the existing installation, but is always ready for use, and when once the poles are correctly defined and connected up, no chances of a reversal in polarity are possible. The introduction of a cell for re-charging purposes makes very little difference to the light. By this means the process of re-charging the Thomson electric accumulator is quite simple and easy, it being only necessary to add some distilled water and slip the cell into the holder. A number of these holders can be connected up in series, and whether a cell is inserted or removed the circuit is still maintained, and, therefore, either one or several cells can be re-charged simultaneously.



HOLDER FOR SMALL CELLS DURING CHARGING.

CATALOGUES, PAMPHLETS, &c., RECEIVED

SMALL DYNAMOS AND MOTORS.—In ELECTRICAL ENGINEERING, Feb. 4th (p. 52) we described a new line of continuous-current motors which have been introduced by the British Thomson-Houston Co., Ltd. (Rugby). We have now received from the company a complete price list of these motors, together with a descriptive pamphlet relating to machines of similar design wound as generators.

BRAKE MAGNETS.—Another new B.T.H. list gives full particulars of a series of sizes of alternating-current brake magnets of the direct pull type.

LIGHTNING ARRESTERS.—Lightning arresters of the multigap type with grade shunt resistance are described in a further pamphlet from the British Thomson-Houston Co. These are standardised for voltages up to 37,000 volts. Choke coils, and other accessories for use in connection with this form of lighting and surge protection, are also included. The chief feature of this arrester is that it provides selective circuits whereby a discharge of any frequency finds an easy low impedance path to earth. One path with high shunt resistance and a small number of series gaps is for discharges of low frequency or for discharging the gradual accumulation of static electricity. A second path with low shunt resistance and a larger number of series gaps will carry heavier discharges and those of medium frequency. A third path with gaps only is for discharges of extremely high frequency.

VACUUM CLEANERS.—An attractive folder from the Electric Suction Cleaner Co. (56 Victoria Street, S.W.), embellished with a portrait of a satisfied user, calls attention to the advantages of the Frant Premier Suction Cleaner from a domestic point of view.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Barking.—The Borough Electrical Engineer has prepared a report upon extensions to the plant and mains.

Batley.—A loan of £6,500 for electrical extensions has been sanctioned by the L.G.B.

Darlington.—A loan of £13,000 is to be applied for to meet expenditure on mains, services, and transformers during the next three years.

Heywood.—A L.G.B. inquiry concerning a loan of £12,460 for electrical extensions has been held. (We refer to this inquiry in an article dealing with the Treasury restrictions as to borrowing.)

Hove.—A 500 kw. mixed pressure turbo-generator and surface condensing plant is required; also a 600 ampere-hour battery. Borough Electrical Engineer. March 26th.

Kingston-on-Thames.—The Borough Electrical Engineer recommends sanction to a loan of £11,000 for mains, services, meters, &c., during the next four years.

London: Hackney.—As certain difficulties have arisen regarding the proposed loan of £10,000 from the L.C.C. for electrical extensions, arrangements have been made with the London City and Midland Bank for a loan. The Electricity Committee has been in communication with the Treasury, and has been informed that their consent is not needed to this borrowing. The loan is at 4½ per cent.

Wednesbury.—A loan of £1,086 for giving a supply in the King's Hill district has been sanctioned.

Miscellaneous

Cardiff.—Twelve months' supply of electrical stores. Town Clerk. March 18th.

Carlisle.—Six months' supply of general stores for the Electricity Department. Borough Electrical Engineer. March 31st.

Chichester.—Twelve months' supply of electric lighting sundries for West Sussex County Asylum. Clerk, March 23rd.

Doncaster.—An expenditure of £5,800 is contemplated upon tramcars.

Liverpool.—Six months' supply of electrical stores for the West Derby Union. Clerk, Brougham Terrace. March 16th.—The Toxteth Park Guardians also require similar supplies for three months. Clerk, 15 High Park Street. March 25th.

London: Wandsworth.—One month's supply of electrical fittings for the Union. Clerk, St. John's Hill. March 15th.

Merthyr Tydfil.—Six months' supply of electrical stores for the Guardians. Clerk, 184 High Street. March 16th.

Richmond (Surrey).—Twelve months' supply of electric lighting and telephone fittings for hospital. Clerk, Mogden Isolation Hospital, Isleworth. March 15th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Cardiff.—The tender of Messrs. H. J. Cash & Co., of London, at £2,400, has been accepted for the electric wiring of the new technical institute.

Eastbourne.—The Electricity Committee recommends the purchase from the Brush Electrical Engineering Co. of a 1,250 kw. Ljungstrom turbo-alternator at £5,300. In presenting the report, the Chairman of the Electricity Committee paid a compliment to Mr. J. K. Brydges, the Borough Electrical Engineer, who, he said, during the twenty years he had been with the Council, had never led the Committee astray in any of his recommendations.

London: Hackney.—The tender of Messrs. John Spencer, Ltd., at £1,060 for pipework and valves in connection with a 5,000 kw. turbo-alternator, is recommended for acceptance.

Maidstone.—The Corporation has accepted the tender of the Brush Electrical Engineering Co. for a 1,250 kw. Ljungstrom turbo-alternator at £6,887.

West Ham.—A contract has been placed with Venner & Co. for a twelve months' supply of Chamberlain and Hookham A.C. meters.

Winchester.—A contract has been placed with Venner & Co. for a twelve months' supply of Chamberlain and Hookham's D.C. meters.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Canada.—Mr. Wickes, H.M. Trade Commissioner for Canada, an interview with whom appears on p. 109, is now at the Commercial Intelligence Department of the Board of Trade every day, and will be only too pleased to give information and advice to manufacturers as to the appointment of agents, methods of marketing and distribution, terms of payment, names of probable buyers of British goods, statistics of imports, and rates of Customs duties, in Canada. In order that appointments may be satisfactorily arranged, firms who may desire to have an interview with Mr. Wickes are requested to make their applications as soon as possible. Such applications should be addressed to the Director, Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

Mr. Wickes expects to be in London for not more than a fortnight, after which he will visit such trade and industrial centres in the provinces as it may appear most advantageous to visit in view of applications that may be received from firms in or near those centres, and from Chambers of Commerce.

Price of Copper.—Although the metal exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £69 10s. to £70 (last week, £69 5s. to £69 15s.).

Changes of Address.—The London & Rugby Engineering Co., Ltd., have removed to 36 & 37 Queen Street, E.C., which is also now the London address of the Rugby Lamp Co., Ltd., and Jas. Procter, Ltd. (telephone, City 5252; telegrams, Cleodora, Cannon, London).—The Dussek Bitumen Co. have moved their headquarters to their additional works at Empress Wharf, Bromley-by-Bow, E. Certain of their products will still be manufactured at Deptford, but all correspondence should be sent to the above address. (Telephone, East 4127).—Pitter's Ventilating and Engineering Co., Ltd., have removed their offices to their works at 33 Nightingale Vale, Woolwich, S.E. (Telephone, Woolwich 427.)

Russian Agency.—An agent at Grosny desires to represent United Kingdom manufacturers of electric lamps and accessories. Further particulars at 73 Basinghall Street, E.C.

Bankruptcy.—G. J. Parfitt, Consulting Electrical Engineer, 11 Priory Road, Keynsham, has been adjudicated a bankrupt. The first meeting of creditors took place yesterday, and the public examination will be held at the Guildhall, Bristol, on April 16th, at 12 noon.

Lundberg's Switching Competition.—“W.E.S.” referring to the results of this competition published in ELECTRICAL ENGINEERING, writes that one outstanding feature, however, which illustrates how the art of switching is coming to the fore, not merely as a novelty but as a means of efficiently controlling various electrical apparatus, in that the various Polytechnics are giving greater attention to the subject. The recent list contains the names of no fewer than 17 students of the South-Western Polytechnic who have succeeded in gaining between them, one cash prize, five book prizes, and 17 certificates. East Ham Technical College students obtained one book prize and three certificates.

Ozonair Generators.—The Edison Swan United Electric Light Co., Ltd., have an excellent window display of “Ozonair” generators at their showroom at 123-125 Queen Victoria Street this week, and have also a large range of these in the showroom itself. The uses of this apparatus for the purification of air in rooms and offices, and for the destruction of smells in kitchens, lavatories, &c., are probably well known to most of our readers, but many may not have seen the actual apparatus, and should take the opportunity of inspecting it at the Ediswan showrooms.



APPOINTMENTS AND PERSONAL NOTES

Mr. A. P. Trotter asks us to state that his official address is 8 Richmond Terrace, Whitehall, London, S.W., and not the one printed in the List of Members of the Institution of Electrical Engineers.

Mr. A. W. Lunn, of Sunderland, has been appointed Shift Engineer at the Stuart Street Station, Manchester, at a commencing salary of £175 rising to £200.

The salary of Mr. S. H. Penning, Deputy Borough Electrical Engineer at Woolwich, is to be increased by two increments of £15 to a maximum of £250.

Mr. Reginald P. Wilson is now on his way back to London after an extended visit to South America.

A Colliery Engineer is required for China.

LOCAL NOTES

Kingstown.—*Arbitration Award.*—The award in the recent arbitration to determine the price which the Council should pay the Dublin Southern District Electric Supply Co. for their Kingstown Electric Lighting Order, is £3,068. This is regarded as a high figure, and there is a general feeling that the Council has been badly hit over the transaction. It may be recalled, however, that the obtaining of the Order in question has involved costly negotiations extending over two or three years, and the point as to whether the Council should pay these, or some proportion of them, was the main argument before the arbitrator.

Leyton.—“Linking-Up.”—The question of the possible linking-up of the Council's electricity undertaking with Hackney has been referred to the Lighting Sub-Committee for consideration.

London.—*St. Marylebone.*—*Inclusive Tariff for Heating and Cooking.*—Mr. A. H. Seabrook, the Borough Electrical Engineer, has devised a tariff for heating and cooking on the basis of an annual charge, plus ½d. per unit, to include charge for hire of apparatus. Hitherto the tariff has been an annual charge, plus ½d. per unit, for current together with rentals for the apparatus.

Islington.—*Councillor “Arrested.”*—An amusing incident at the electricity works is reported in our contemporary, the *Islington Gazette*. It appears that Councillor Clarke called at the electricity works to see Mr. Gay, the Borough Electrical Engineer, who was, however, not on the premises. Subsequently he was inspecting the coal stocks, when he was observed by two sentries, “arrested” and escorted off the works. From the interview which he gave to our contemporary, Councillor Clarke seems to be greatly concerned at the indignity to which he feels he has been put, but the central fact which emerges from the incident is not one of sympathy for the Councillor, but one of satisfaction at the adequacy of the steps taken to protect the works.

Yorkshire.—*Opposition to Power Bill.*—A Joint Committee of representatives of West Riding County Boroughs has been appointed to watch the progress of the Yorkshire Electric Company's Power Bill. The Chairman of the Bradford Corporation Electricity Committee and the Town Clerk have been nominated to represent Bradford. There are signs, however, that a considerable portion of the opposition will be met.

COMPANIES' DIVIDENDS, REPORTS,
MEETINGS, &c.

W. T. Henley's Telegraph Works Co.—A final dividend, making 15 per cent. for the year, with a bonus of 5s. per share less tax, is declared for 1914, as for the previous year.

City of London Electric Lighting Co.—A final dividend, making 9 per cent. on the ordinary shares for 1914, is announced, compared with 10 per cent. last year. £50,000 has been placed to reserve.

Newcastle-on-Tyne Electric Supply Co.—A final dividend, making 5½ per cent. for 1914, the same as in the previous year, is recommended. The depreciation account is credited with £20,000.

British Insulated & Helsby Cables.—Owing, it is stated, to large Government and railway contracts last year, the dividend for 1914 is 15 per cent., compared with 13 per cent. in 1913. The sum of £88,500 is carried to reserve, and £119,000 carried forward.

Charing Cross, West End & City Electricity Supply Co.—Reference was made at the annual meeting last week to the position regarding electric supply in London. Mr. F. W. Fladgate, the chairman, said that the directors had always held the view that a gradual change was the only economical and wise course, and they were quite willing, on fair terms, to co-operate. Although the L.C.C. Bill had been abandoned for the session, the directors were quite willing, provided they were fairly met, to advise the sale of their undertaking to the L.C.C. It must be understood, however, that the Company expect to be treated generously, and that the price to be paid must be very different from that provided under the Electric Lighting Acts. At the same time it was far from being admitted that London is badly served in the matter of electric supply.

Metropolitan Electric Supply Co.—A final dividend, making 3½ per cent. for 1914, is recommended, compared with 4½ per cent. in the previous year. The depreciation and reserve fund has been credited with £22,000, and the balance of £38,795 is carried forward. The gross revenue is about £2,000 less than in the previous year, all of which loss was incurred during the last half, due to war conditions.

South Metropolitan Electric Light & Power Co.—At the annual meeting last week, Mr. H. W. Bowden, the Company's Engineer, stated that notwithstanding the abnormal conditions last year, the costs of generation were again the lowest on record for the Company. The new turbine plant has been largely responsible for this, another factor being the use of coke breeze as fuel obtained from the gas works adjoining the Company's power station. The results obtained with a test boiler using this fuel have proved eminently satisfactory. This is believed to be the first installation of its kind in an electric power station in this country.

Waste Heat & Gas Electrical Generating Stations.—The directors report that no new generating stations have been erected during 1914, but negotiations are taking place for additional plant to be installed at the Weardale and Grangetown power stations.

British Westinghouse Co.—A dividend of 7½ per cent. is declared on the preference shares for 1914.

Arrangements for the Week.—(To-day) Thursday, March 11th.—Institution of Electrical Engineers. “Electric Cooking Mainly from the Consumer's Point of View,” by W. R. Cooper. 8 p.m.

Friday, March 12th.—South-Western Polytechnic, Chelsea. Prize distribution. 8 p.m.

Physical Society, Imperial Institute, S. Kensington. (1) “The Unit of Candle Power in White Light,” by C. C. Paterson and B. P. Dudding. (2) “The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (R.M.S.),” by G. L. Addenbrooke. 8 p.m.

Saturday, March 13th.—Birmingham and District Electric Club, Swan Hotel. “Electric Vehicles,” by W. E. Warrilow. 7.30 p.m.

Monday, March 15th.—Institution of Post Office Electrical Engineers, at I.E.E., Victoria Embankment. “Telephone Engineering Economics,” by H. A. Smith. 6 p.m.

Tuesday, March 16th.—Illuminating Engineering Society. At Royal Society of Arts. Discussion: “The Marking and Rating of Lamps and the best Methods of Specifying, their Illuminating Value.” 8 p.m.

Wednesday, March 17th.—Institution of Electrical Engineers, Birmingham Section. Mr. W. R. Cooper's paper on “Electric Cooking” will be read. 7.30 p.m.

Institution of Electrical Engineers, Students' Section, Victoria Embankment. “Some Experiments on the Induction Generator,” by W. H. Date. 7.45 p.m.

Ediswan Lamp Shades.—The Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), are sending out to their friends very neat little cardboard lanterns with translucent miniature reproductions of their famous Sun worship poster, which can be used for shielding window and showroom lights.

James Macintyre & Co. Ltd.
Manufacturers of
PORCELAIN
INSULATORS
of every
description
Washington Works, Burslem.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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SUMMARY

A LARGE electric cooking installation capable of providing a *table d'hôte* dinner for 500 persons has been inaugurated at the Bradford Kursaal (p. 114).

WORK has been commenced on the site of the new generating station of the Glasgow Corporation at Dalmarnock, which is ultimately to have a capacity of about 140,000 kw. (p. 115).

JUDGMENT has been given against the Robin Electric Lamp Co., Ltd., on their application for a compulsory licence under certain patents relating to drawn tungsten wire held by the B.T.-H. Co. and Siemens Bros. Dynamo Works, Ltd. Mr. Justice Warrington held that the patentees had fully met the needs of the public and that no new industry has been prejudiced by the conditions which they sought to impose upon the Robin Co. (p. 115).

A PAPER dealing with electric cooking from the consumer's point of view, by Mr. W. R. Cooper, was read at the Yorkshire Local Section of the Institution of Electrical Engineers last week, and was discussed at the London meeting of the Institution last Thursday. The paper was somewhat severely criticised in the discussion in London, for it was generally felt that the results obtained were those of an isolated experiment, the conditions attaching to which were by no means normal. The cost of the apparatus was regarded as extremely high, and the necessity of hiring cookers was emphasised. Mr. Seabrook mentioned that Messrs. Selfridge are now putting down the largest electric cooking outfit in the world, which will be capable of cooking for the whole of their staff (p. 116).

A SUB-COMMITTEE of the Engineers' Club, Manchester, has issued a report urging the formation of an Association of British Engineering Manufacturers, to take in hand the organisation of the engineering industry and fit us to the utmost for competition with Germany in the future (p. 118).

DR. L. DE FOREST has devised a new detector for continuous waves (p. 118).

STORAGE battery omnibuses are to be run in New York in competition with tramways (p. 118).

THE calculation of the whirling speed of a steel shaft is dealt with in our "Questions and Answers" columns (p. 119).

SPECIFICATIONS dealing with the Squier "wired wireless" telegraph system, cooking apparatus, lamp leading-in wires, and avoidance of interference with telephones by A.C. railway circuits were published by the Patent Office last Thursday. Application has been made to suspend several enemy-owned patents relating to the manufacture of aluminium coils with aluminium oxide insulation. A Patent has been granted to W. Aitken for a semi-automatic telephone system in spite of opposition, and to the B.T.-H. Co. for a system of winding motor control by liquid rheostats. A meter patent of A. C. Heap and W. O. Smith expires this week after a full life (p. 120).

A NUMBER of reflectors for incandescent lamps are illustrated in our Trade Section, which also describes an electric turret clock, lamp standards of insulating material, and an ironclad switch (pp. 121 and 122).

A 650 kw. rotary-converter and static transformer are required at Manchester; a £10,000 scheme of extensions at Leigh has been referred back; a loan of £6,500 has been sanctioned at Batley; the Deal & Walmer Gas & Electricity Co. has received Treasury sanction to issue new capital for electrical purposes; a 150-ton electric crane is required at Sydney (Australia); and a £35,000 extension scheme is proposed at Colwyn Bay (p. 123).

SOME discussion is taking place in Manchester in consequence of the possibility of the Treasury capital restrictions holding up the construction of the new Barton power station. Disappointment has also been expressed at Bury in this connection.—The charge for current is to be increased at Pembroke (Ireland).—The rateable value system of charging is to be adopted at Loughborough (p. 124).

THE dividend on the ordinary shares of the British Electric Transformer Co. is 2½ per cent. less than in 1913.—The Brompton & Kensington Electricity Supply Co. has declared 10 per cent., as in 1913 (p. 124).

THE Doncaster and Dewsbury Corporations have obtained wiring powers, but the work is to be carried out through a contractor (p. 124).

(For Arrangements for the Week see p. 115.)

ELECTRIC COOKING AT BRADFORD

A LARGE electric cooking installation has been carried out at the Bradford Kursaal capable of providing a *table d'hôte* dinner for 500 persons, and a large company assembled on Tuesday of last week at

only pressure of business and shortage of plant that prevented the establishment of a hiring scheme for electric cookers. The extension to the Valley Road plant, at a cost of £90,000, was now well advanced towards completion. Some new plant was in commission; it was hoped the new battery would be put in during the next few weeks, and that the new turbine would be running in the early summer. A record profit of £15,000 was

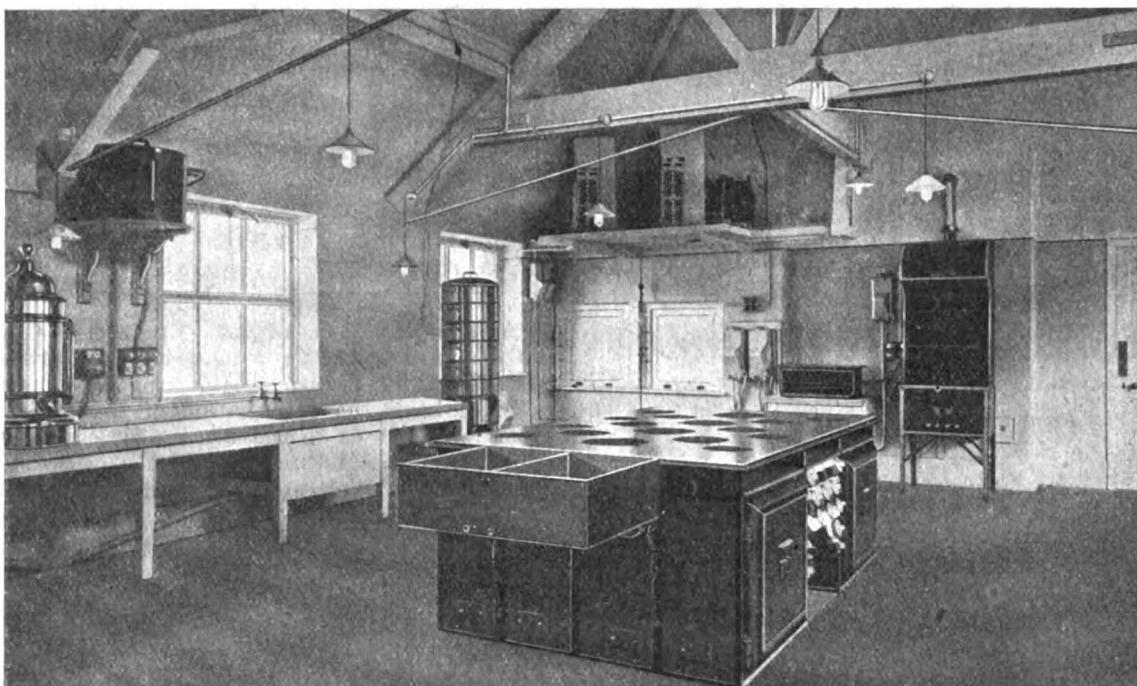


FIG. 1.—MAIN KITCHEN.

the invitation of the chairman (Cr. J. Haley) and members of the Electricity Committee of the City Council to inspect the installation and to partake of an excellent dinner in the Queen's Hall, which was cooked entirely electrically. The installation was supplied to the order of the Bradford Baths Committee,

made by the Department last year, but probably the profit for the current year would not reach that mark. Mr. Roles, who proposed "The Contractors," said that electric cooking was no new thing, and remarked, incidentally, that the only means of cooking a hot meal on a submarine was by means of electricity.

Views of the kitchen and the servery showing a quantity of the apparatus are given in our illustrations. The main central range (which is fitted with a bain marie) is over 9 ft.

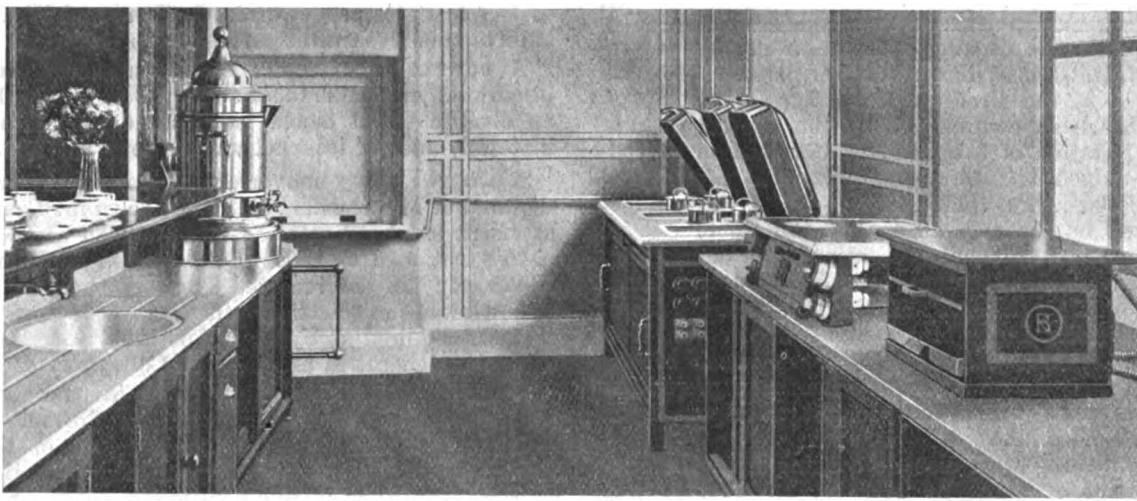


FIG. 2.—SERVERY OF CAFÉ.

and is largely due to the initiative of the chairman, Ald. H. M. Trotter.

After dinner, the Lord Mayor of Bradford (Ald. G. H. Robinson) proposed the toast of "The Kursaal and its electrical cooking installation," to which Ald. Trotter responded, expressing the belief that the time would come when electric cooking would be in extensive domestic use. The rapid advance in the Bradford electricity undertaking was referred to by Mr. S. Neumann, who, in proposing "The Department," said that in the last 20 years the consumption had increased more than fiftyfold. Cr. J. Haley replied that its success was largely due to Mr. T. Roles, the City Electrical Engineer, and it was

long. It is fitted with four ovens taking 4 kw. each, each about 2 ft. cube, and the frame is of cast-iron stove enamelled black with ground bright facings and bright boiling table. This boiling table is fitted with four 12-in., five 10-in., and eight 8-in. boiling rings, taking 2, 1'5, and 1'2 kw. respectively. The ovens and boiling rings are arranged for three degrees of heat regulation. The switches and fuses are mounted in conspicuous and easily accessible positions, and each oven and boiling ring has an indicator lamp to show when the current is on. The bain marie (2 ft. 8 in. by 1 ft. 9 in. by 6 in. deep) is divided into two compartments separately controlled by switches and fuses. Its maximum consumption is

3 kw. A circular steamer tinned inside and nickel-plated outside, 19-in. diameter, with six 6-in. deep steaming compartments fitted internally with steam channels and draining holes, is also provided. The steamer is controlled by three heaters of an aggregate capacity of 4·5 kw., which may be used singly or collectively. Another piece of apparatus is a fish or potato frier of blue planished steel with bright mouldings, and having a compartment 2 ft. by 18 in. of ample depth. This is fitted with two 2-kw. heaters, and is controlled by four switches for easily controlling the temperature of the fat in which the frying takes place. The grill has a grilling area of 24 in. by 12 in., and is made of cast-iron, and fitted with grill guard, grilling grid, and drip tin. It is rated at 4·5 kw. maximum.

One 10-gallon 4·5-kw. nickel-plated copper hot-water urn is provided for drinking purposes, and a 10-gallon copper cylinder mounted on the wall, fitted with ball cock and water gauge, is used for providing hot water for washing-up purposes, pipes being connected to sinks for this purpose. This is rated up to 6 kw. maximum.

In the ground-floor café there is one carving table and hot cupboard measuring 6 ft. 6 in. by 2 ft. 6 in. by 2 ft. 9 in. mounted on castors, fitted with three tinned copper carving dishes 19 in. by 14 in., with hinged covers, and four 7-in. nickel-plated gravy- and sauce-pots. The hot cupboard underneath has an internal dimension of 5 ft. 9 in. by 2 ft. 1 in. by 2 ft. high. There are three regulations of heat provided with this apparatus, which works up to 3·5 kw. Other apparatus comprises a 5-gallon double-lined nickel-plated 2·5-kw. coffee or milk urn, a 10-gallon 3·5-kw. hot-water urn for drinking purposes, a 2·5-kw. toaster with a working surface of 17 in. by 11 in., a breakfast cooker containing two 8-in. boiling rings, one 6-in. boiling ring, and one 11 in. by 8½ in. grill.

A 4-kw. electric hot-water geyser is also fitted in the counter for providing hot water for washing-up purposes to two wash bowls.

The middle café is fitted with one 2·5-kw. toaster, one 3·5-kw. hot-water urn for providing water for drinking purposes, one 2·5-kw. coffee or milk urn, and an electric 4·0-kw. geyser fitted to the wash bowls. Electrically-heated 150-watt towel rails are provided in each of the cafés.

The above plant, with the exception of the geysers and towel rails, has been supplied by The Brompton & Kensington Accessories Co., Ltd. (London), to whom we are indebted for the above particulars; the geysers and towel rails were supplied by the British Electric Heater Co. of Glasgow.

THE NEW GLASGOW GENERATING STATION

THE Electricity Committee of the Corporation of Glasgow paid a visit last week to the site of the large new electricity works which is under construction at Dalmarnock Bridge. This site, adjoining the Dalmarnock Road, was purchased in November, 1911, and originally consisted of 33,677 sq. yds., but a subsequent purchase from the Caledonian Ry. Co. raised the total area to 64,809 sq. yds (13½ acres). The total cost of the site was £27,112, or 8s. per sq. yd. An ample supply of condensing water is obtainable direct from the Clyde, and railway sidings are already laid on the site. The first portion of the works, which is now under construction, consists of a water intake, a screening house, two water culverts (one for the inlet water and one for the outlet water), switch house, turbine room (75 ft. by 240 ft.), two boiler houses, each 150 ft. by 84 ft., workshop and store, and a complete coal-handling plant capable of dealing with 100 tons of coal per hour. Contracts were placed for the excavation of the ground in April, 1914, and subsequently in August for the water channels and concrete foundations. These contracts amount to a total of £48,000. The contract for the coal-handling plant has also been placed, and the cost of this portion of the work amounts to £24,800. Offers will shortly be asked for the first portion of the buildings, and specifications for the first instalment of plant are practically ready. This plant will consist of two 10,000-kw. and one 15,000-kw. turbo-alternators. There will also be three 1,000-kw. turbo sets for driving auxiliary machinery, and all the necessary condensing plant and circulating pumps. It is proposed to continue installing plant units of 15,000 kw. as the demand increases, but units of 30,000 kw. can be installed if found desirable. The ultimate capacity of the Dalmarnock works will be at least 140,000 kw. It is intended to transmit electricity from the works at a pressure of 20,000 volts (three-phase alternating, 25 periods per second) to existing distributing centres at Port Dundas,

St. Andrew's Cross, Govan, and Partick. There the energy will be transformed from 20,000 to 6,500 volts, and distributed at this pressure to existing sub-stations, where again it will be transformed to low-pressure current for the general supply throughout the city. A considerable length of new cable ducts will require to be laid, and it is hoped that the first part of the Dalmarnock works will be ready to deliver energy at the beginning of the winter of 1916-17. With reference to the growth of the load on the Glasgow system, it is interesting to note that at the end of 1914 the total demand applied for was just short of 90,000 kw., a figure which has more than doubled itself since 1907. The maximum plant in the station is about 55,000 kw., also about double that in 1907, and the maximum load about 39,000 kw.

DRAWN TUNGSTEN LAMP FILAMENTS Compulsory Licence Refused

M R. JUSTICE WARRINGTON on Friday gave judgment in the action in which the Robin Electric Lamp Co., Ltd., applied for a compulsory licence to manufacture drawn tungsten wire under nine patents held by the British Thomson-Houston Co., Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd. We reported the hearing of the case in our issues of March 4th and 11th, pp. 90 and 105.

After drawing attention to the fact that this was the first application of the kind under Sections 24 and 27 of the Patents Act of 1907, Mr. Justice Warrington said a good deal turned on the precise meaning of the wording of these sections. He held, however, that an applicant for a compulsory licence must prove that the patentees had not met the reasonable requirements of the public as distinct from those of a particular individual. Mere default on the part of the patentee to supply the patented article or to grant licences in particular cases would not bring the patentee within the sections in question, as a sufficient number of licences might already have been granted. It must also be proved by an applicant that an existing trade or industry as a whole was affected by the action of the patentee, or that a new industry was prejudiced. It was true that the effect of the policy of the Tungsten Lamp Association was that the price of drawn-wire electric lamps in this country was considerably higher than abroad, but there was no evidence that it was so high as to be a serious burden on the consumer or to be unreasonable; the supply of lamps was adequate to meet the demands of the public. The actual petition in this instance was concerned with the supply of drawn tungsten wire. A supply of wire had been offered on terms which would add 10d. to the cost of the lamp which the Robin Co. desired to make. It had been established on the petitioner's own evidence that there was no industry in which tungsten wire was used except lamps, and he was of opinion that the needs of the public are amply satisfied in respect of lamps. The manufacture of a new form of lamp by the petitioners would not establish a new trade. The Robin Co. would simply be a new trader in an existing industry, and there was no evidence that the existing industry had been in any way prejudiced by any Act or condition of the patentees.

The petition was therefore dismissed with costs.

Arrangements for the Week.—(To-day) Thursday, March 18th. Greenock Electrical Society, 21 West Stewart Street. "Suction Gas Plant," by E. P. Duckworth. 7.45 p.m.

Friday, March 19th.—Association of Mining Electrical Engineers, West of Scotland Branch. Royal Technical College, Glasgow. "The Use and Abuse of Oils," by T. C. Thomson. 4.30 p.m.

Electro-Harmonic Society. Last Smoking Concert of the Season. Holborn Restaurant. 8 p.m.

Saturday, March 20th.—Association of Mining Electrical Engineers, Notts and Derbyshire Branch. University College, Nottingham. (1) "Turbine Pumps for Colliery Pumping," by R. H. Willis. (2) "Utility of Surface Earthing on Armoured Systems," by W. Webster. 3.30 p.m.

Tuesday, March 23rd.—Institution of Electrical Engineers, Manchester Section. Engineers' Club. "Electric Cooking mainly from the Consumers' Point of View." 7.30 p.m.

Wednesday, March 24th.—Institution of Railway Signal Engineers, at I.E.E., Victoria Embankment, E.C. Resumed discussion on Mr. Bound's paper, "A Review of the Art of Signalling and Some Suggestions." 2.15 p.m.

Thursday, March 25th.—Institution of Electrical Engineers. "Telephone Troubles in the Tropics," by W. L. Preece. 8 p.m.

ELECTRIC COOKING

IN a Paper read on Wednesday of last week before the Yorkshire Local Section of the Institution of Electrical Engineers, and discussed in London last Thursday, Mr. W. R. Cooper took up the subject of electric cooking mainly from the consumer's point of view. He gave some results of experience in a particular case of a household of eight or nine persons using a cooker consisting of an oven with an upper heater taking 2,000 watts and a lower heater of 1,000 watts, a 1,500-watt grill, two 8-in. 1,200-watt hot plates, and one 6-in. 750-watt hot plate. In this case a separate coke-fired boiler was used for water heating, but the author did not look upon electrical water heating as a financially impracticable proposition where a suitable tariff was in force, which took into account the practically continuous load obtainable with a thermal storage form of water heater. He urged the practicability of a quarterly charge for water heating on the basis of continuous use at the rate of 4d. per kw.-hour. In his case the average consumption for cooking was about 2 kw.-hours per day per person in winter time, and about 1.6 in the summer, or 110 and 90 kw.-hours per week respectively. He had found an increase in cost over that of coal cooking; for, whereas his annual coal and electricity cost was £23 10s. before electric cooking was adopted, it had now increased to £32 8s. 9d. The complete original outfit, including £9 4s. 5d. for wiring and £10 6s. 4d. for the coke boiler, had cost £45 11s. 3d. Subsequently an 800-watt porringer had been added at a cost of £4. The prices of first-class cooking appliances would probably decline as they were manufactured in larger quantities. Again, the wiring as usually carried out in screwed tubing seemed unduly expensive, and he suggested that armoured cable, without further protection, would answer the purpose.

Going into details of cooking equipment, he spoke of the necessity for a main d.p. switch and brightly visible pilot light near the cooker, but did not consider pilot lamps desirable on every circuit. The branch switches should be placed in some convenient place where they can be easily seen, such as on the wall near the cooker, and the main fuse should be supplemented by easily replaceable fuses for each circuit. He emphasised strongly the advantages of a thermometer in the door of the oven. With regard to the much talked-of question of the saving due to the smaller loss of weight of the meat with electric cooking, he thought that the importance of this had been rather overestimated, and that it depended more on the temperature of the oven than on the fact that the heating was done electrically. A number of his own observations had given an average loss of weight of 25 per cent. with coal, 14 $\frac{1}{2}$ per cent. with an electric oven, at the correct temperature, and 28 $\frac{1}{2}$ per cent. with the temperature about 50 degrees too high. Such statements as "if gas were provided free it would still be cheaper to cook electrically" were absurd, and only did harm to a good cause. It must not be forgotten that the roasting of joints was but a small part of the total cooking. The energy required to heat an oven was not so great as might be expected. In his case, with 3 kw., a temperature of 250° F. could be reached in five minutes, but, even so, it was preferable to avoid the use of the oven for small operations, such as keeping dishes hot, if it is not already in use. For such purposes, the author had used a portable oven consisting of a tin hood placed over an ordinary hot plate. The heating up of an oven should take place so rapidly that the heat losses had not much time to take effect, after which the input could be reduced simply to supply these losses.

There was room for improvement in the design of plug and socket connections. Mr. Cooper suggested an earthing metal ring round the socket so that the pins were not exposed at all when live, as preferable to the hand shields sometimes provided. Also the live metal of the socket was often brought nearer the surface than necessary, and could be touched when cleaning. In cases where the pins were on the apparatus itself and the socket on the flexible, it was desirable to surround the pins by a housing, and to see that no live heads of clamping screws, &c., were exposed in the terminal blocks of the flexible. There was also some risk of the helical springs, which are sometimes provided to protect the flexible where it leaves the plug, becoming live by wearing away by the insulation or careless stripping of the flexible. A trumpet-mouthed opening to the plug was a better protection. Ordinary flexibles were very liable to break on account of being continually subjected to bending, and many of the usual cords supplied were quite unsuitable to this class of work. Special patterns were, however, now becoming available. In seeking to meet this need, cable-makers seemed

to be following two opposed methods. The first was to make the flexible wire so that it bends very easily and will therefore adapt itself. The second was to make the flexible wire rather stiffer, so that any bend will be less sharp. The author is inclined to think that the latter is the better alternative because the breaking of the copper strands depends on the sharpness of the bend.

The author has tested a large number of samples in a special machine, subjecting them to repeated bending many thousands of times, and a great variety of results were obtained. He also measured the "inflexibility" by noting the overhang of a weighted wire allowed to hang over a right angle corner. From the user's point of view, both the diameter and inflexibility should be small. The special flexible wires mostly have larger conductors than the ordinary ones, and have larger diameter and less flexibility. Many are circular. Although the circular type has the advantage of better shape for mechanical wear, from the electrical point of view, this form, he imagines, has the disadvantage that if one conductor fails there is greater chance of a short-circuit than with twisted twin conductors. Some of the armoured wires failed through failure of the wire braiding, which thus allowed more severe bending at this particular point. The author thinks it is apparent from these tests that ordinary flexible wires vary very much in their mechanical properties, and that it is not necessary to depart from the ordinary type to get excellent results. On the basis of the test as carried out, he thought that a flexible wire suitable for portable apparatus should be capable of bearing 200,000 complete bends without breaking. It is not an uncommon thing to see long lengths of flexible cable lying about the floors of houses for supplying radiators. In course of time this flexible cable must wear and eventually develop a fault. As a rule radiators are fitted with switches controlling all the heating elements, the result being that the flexible wire is left permanently alive. In the Institution Wiring Rules it is recommended that radiators should be made so that they can only be partially controlled in this way, but no heed is generally paid to this very desirable rule. This is due to the wrong idea that convenience should take precedence of safety.

Mr. Cooper emphasised the necessity for earthing all cooking apparatus efficiently; a point to which insufficient attention was paid, unfortunately, he said, there was no authority having the power to enforce such earthing. There was particular danger in having unearthing accessory apparatus alongside an earthed cooker. He suggested that the Institution should draw up rules as to the proper methods to be employed for earthing and for testing earth connections. The standardisation of socket connections on electric irons, &c., might be considered at the same time.

In the latter part of the paper, the author said a few words on the much-discussed question of tariffs. He objected to primary charges based on such a figure as rateable value, which has no relation to the amount of working apparatus in use, and urged the necessity of a low secondary charge. He said that, in his own case, some of the tariffs in use by the members of the Point Fives Association would have shown very little difference in the cost between electricity and coal. With regard to maintenance, his oven had shown no defect in the thirteen months of use, and the grill only gave one partial failure. He was inclined to think that the hot plate was the most vulnerable part of the equipment. But whatever the cost of maintenance might ultimately be, it was of vital importance to the consumer, and there should be more co-operation between the station engineer and the manufacturer in the matter.

The daily load factor of his installation worked out at 7.1 per cent., or, for the working period of 15 $\frac{1}{2}$ hours, a little over 10 per cent. Since the product of load factor and diversity factor cannot exceed 100, it follows that the diversity factor of this particular type of consumer could not be greater than 10, but it might reach that satisfactory figure. Actual records showed how the load is distributed throughout the day and varies from day to day, and considering the diversity of different classes of consumers and that the lighting and cooking peaks do not coincide, it was evident that the cooking load was a very desirable one from the central station point of view.

The discussion in London was long and at times the author was rather severely handled. Fourteen speakers took part, and a good proportion severely criticised the author for drawing general conclusions from an isolated experiment. Mr. S. T. Allen (Chief Electrical Engineer, Wolverhampton), Mr. R. S. Downe (Brompton & Kensington Electricity Supply Co.), Mr. F. S. Grogan (British Electric Transformer Co.), Mr. Haydn Harrison, Mr. A. H. Seabrook, Mr. F. Charles Raphael, and

Mr. A. Nicholls Moore (Chief Electrical Engineer, Newport, Mon.) all found serious fault with the Paper and the general impression it would create. Attention was called to the enormously high price of the cooking apparatus which the author had purchased. Mr. Downe mentioned an installation consisting of a cooker for a private house of about the same size as Mr. Cooper's, 60 ft. of 7/18 paper-insulated, lead-covered cable with double-pole switch and double-pole cut-out, which gave every satisfaction and cost £14. Such an outfit could be hired out for 5s. or 7s. 6d. per quarter. A further reason for hiring was given by Prof. J. T. Morris, viz., the different conditions of supply in various districts, which might render a cooker in one district useless in another. Mr. F. S. Grogan declared that the Paper did not by any means represent the general experience all over the country. In this case a very useful cook had been extraordinarily extravagant, the apparatus had not been efficient, or Mr. Cooper had been too much in the kitchen himself. The Paper was a murderous submarine attack on the excellent progress which had been made with electric cooking. Mr. Haydn Harrison, who had been a user of electric cooking apparatus for years, said his experience had been very different from that of Mr. Cooper. In his house the total yearly expenditure on coal, gas, and electricity had not varied during the last five years, although he had put in electric cooking (at 1½d. per unit) three years ago. Mr. Seabrook characterised the cost of the apparatus as given in the Paper as utterly ridiculous. He could not find consumers to purchase apparatus; they had been spoiled by the gas companies and had to be supplied with the cookers on hire. Mr. Nicholls Moore thought the Paper showed that those who were giving so much attention to tariffs would be better employed if they concentrated upon the education of the consumer, if Mr. Cooper was a typical consumer. Mr. Raphael regretted that Mr. Cooper's extravagant and unsuccessful experiment should have been issued to the public under the auspices of the Institution, not only in London, but also in Leeds, Birmingham, and Manchester.

Several technical points were raised in the discussion. Mr. C. H. Wordingham mentioned that a sub-committee of the Engineering Standards Committee had been appointed to go into the question of standardisation of cooking apparatus. The difficulty here, he said, was whether standardisation should be attempted before the industry, so to speak, had settled down. He thought, however, that certain standard dimensions and standard requirements could very well be settled now. For example, the floor space of the oven, and this in turn would determine the size of the baking dishes, diameter of hot-plates, &c.

There was general disagreement with Mr. Cooper's suggestion of the use of a thermometer. The ordinary cook, it was pointed out, would not bother to use it, unless, perhaps, it could be placed above the oven and always in sight. On the other hand, the desirability of placing the switches away from the sides of the oven, and in a position easy of access, was agreed upon by all the speakers. There was not much disagreement between Mr. Cooper and most of the speakers as to the number of units used per person per day, whilst on the question of embodying a water-heating system with the electric cooker, everybody, except Mr. A. H. Seabrook, was of the opinion that this is an unwise policy and that a coke boiler is likely to give more satisfactory results. Mr. Seabrook, however, said he has a fairly large number of commercial users in Marylebone, who heat water electrically in 70 and 75 gallon tanks, and they are quite satisfied with the cost.

The question of plugs was dealt with by several speakers. It was felt that in view of the increased rating and size of radiators and other apparatus, the sooner the ordinary wall plug was done away with, except perhaps for irons, the better. Mr. Wilkinson said the general tendency is to substitute large switches. Mr. Allen thought Mr. Cooper's suggestion of an earthed ring would introduce a still more dangerous condition of things, and Mr. Raphael said that, peculiarly enough, he had only that day come across a case where shock had been obtained from a plug very similar in design. Mr. Seabrook thought the hand shield plug with the flex coming out at the side, recommended by the Home Office, quite an ideal type, and Mr. Raphael said that it would be generally agreed that the chief virtue of this plug was not so much that it prevented people getting shocks, but that it prevented any strain on the flex when putting it in and pulling it out. Mr. Allen said he had never found any difficulty in securing that the apparatus was earthed, and agreed that it was also of the greatest importance to earth utensils alongside the cooker.

Mr. Raphael regretted that the practice of dividing a cooker between the two sides of a three-wire network had not been discussed. Some makers of apparatus were against this practice and thought it dangerous, and, on the other hand, some central-station men were in favour of it.

Mr. Wilkinson and Mr. Wordingham felt that electric cookers must be made much more reliable than they are before central station can recommend them without qualification. The cost of maintenance was a serious item. No amount of juggling with tariffs, said Mr. Wordingham, would get over this difficulty.

There were some differences of opinion as to the value, from the selling point of view, of figures of comparative wastage of

weight with electric, coal and gas cooking. Mr. A. Nicholls Moore said we must be very badly off for arguments if this one had to be relied upon in view of the infinitesimal financial saving this involved. On the other hand, Mr. Downe mentioned an installation for Messrs. J. Lyons and Co. in which an experiment was carried out on four sirloins of beef, weighing a total of 125 lbs. After cooking the weight was 101 lbs., or a loss of 18·8 per cent. The manager at Cadby Hall had told him that the average shrinkage with a coke fire was 30 per cent.; the gain on these four joints would represent a money saving of 10 per cent. Mr. Seabrook, on the general question of cheapness with electric cooking compared with any other method, said he is now putting in, for Messrs. Selfridge, what will be the largest electric kitchen in the world, capable of cooking for the whole of their employees, and, as most people outside Marylebone probably did not know, Messrs. Selfridge were not the sort of people to put in any unknown or new-fangled equipment unless "they saw dollars at the end of it."

The Enemy's Trade.—An extensive report on the war and British economic policy has been issued by the Tariff Commission. The situation of a number of industries is discussed; with regard to electrical matters attention is specially directed to the large range of electrical goods which have come to this country from Germany, especially of the cheaper kind. These German goods include A.C. drills, small pulley blocks, electric torches and their batteries, electric toys, enamelled ware, small electrical instruments, motor-car equipment, &c., telephones, electrically-driven cow-milkers, insulators, insulating materials, welders, frequency meters, burglar alarm systems, loom motors, electric sirens, miners' lamps, ozone generators, bells, electric blasters, electric punkahs, electric heating and cooking apparatus, resistance wires, massage vibrators, rheostats, lamp testing sets (wattmeters), sign flashers, small signs, Rhumkorff coils, electro-medical apparatus, dental apparatus, fairy strip (Pixielite), small portable tools, sewing machines driving systems, permanent magnets, X-ray bulbs, Geissler tubes, buzzers, projectors, stage arc lamps, metal dimmers for stage work, Christmas-tree illuminations, vacuum cleaners, photometers, carbon brushes, air filters for turbo-generators, asbestos grid resistances, single-phase commutator motors, Edison screw sockets, cheap switches, &c. The view is expressed that, in general, the possibilities for permanently capturing German trade is largely dependent on some guarantee of security from unrestricted foreign competition after the war, and that the necessary capital for extensions will not be forthcoming in the absence of safeguards against post-war dumping.

A Primary Cell Sensitive to Light.—At a recent meeting of the Physical Society, Mr. A. A. Campbell Swinton described a cell which reverses its polarity when illuminated. If two plates—one of zinc and the other of tinned copper coated on one surface with selenium and varnished with enamel over the remainder of its surface—are immersed in tap-water, the electric current through a galvanometer connected to the plates shows that in the dark the zinc is electro-positive to the selenium, while the result of light falling on the selenium is to increase the effect. If, however, instead of zinc, carbon or copper is employed for the non-coated plate, the interesting result is obtained that, while the selenium proves to be electro-positive to the carbon or copper in the dark, it immediately becomes electro-negative to carbon or copper the moment it is illuminated, this being easily shown by the deflections of the galvanometer in contrary directions as the light is turned on and off.

Industrial Conditions After the War.—Mr. D. E. Roberts, chairman of the Western Local Section of the Institution of Electrical Engineers, delivered his address at a meeting at Cardiff on Feb. 23rd, when Sir John Snell, President of the Institution, paid a visit to the Section. Relating the results of observations he had made in industrial Germany before the war, he said the progress made there in labour-saving equipment during the last few years was extraordinary, and must have been due to fear of future labour conditions. In addition to this great productive power he called attention to the advanced state of technical training in Germany, and urged his hearers not to under-estimate what they would have to compete with when the war was over. Our position could only be satisfactorily ensured by putting our works in excellent and high order, and filling them with highly trained men.

The Diesel Engine Users' Association.—At a recent meeting of this Association, the President (Mr. J. E. Edgcome) announced that further particulars were being obtained in connection with the use of Mexican oil fuel, and the subject would be brought up for discussion at a future meeting. The design of certain mechanical details of Diesel engines was discussed in relation to a recent breakdown at Oxford, due to failure of connecting rod belts. The next meeting of the Association will be held on Wednesday, March 17th, at the Institution of Electrical Engineers, when the question of insurance of Diesel engines against breakdown will be discussed. Information concerning the Association can be obtained from the Acting Hon. Sec., Mr. Percy Still, 19 Cadogan Gardens, S.W.

THE ORGANISATION OF THE ENGINEERING INDUSTRY

THE present situation of the engineering industry and the means desirable for dealing with it have been subjects of close investigation by the Engineers' Club, Manchester. Not only have debates been held on various aspects of the question, but a sub-committee has been appointed to go into the matter, and to frame recommendations. We have now received from Mr. E. L. Hill, hon. secretary of the club, a copy of this sub-committee's report. The important fact is first insisted upon that before the war our engineering export trade had not been progressing satisfactorily for some years, while Germany's rate of progress had been phenomenal. The sub-committee is not concerned with the debateable question of how long the German rate of progress could have been maintained had she not cut her own throat by going to war, but inquires into the causes of the success obtained, and summarises them in the one word—organisation—the very thing that it considers to be the weak spot of the British engineering industry. The only way to compete with even moderate success for foreign business, it asserts, is by voluntary organisation and co-operation. The only alternative (which it would be sorry to see) is the formation of trusts and combines on the American and German plan, which is foreign to the British spirit of independence. The sub-committee, therefore, recommends the formation of an association, on a non-trading and "non-interference-with-prices" basis, comprising British manufacturing concerns in all branches of engineering, with a strong representative council that could speak with a powerful collective voice in matters in which the Government or Parliament play a part. Such an association should have a central bureau or exchange, as well as branches in provincial towns and overseas. Some idea of the scope proposed is obtainable from the following list of departmental standing committees which are suggested:—Parliamentary and General Purposes, External (Sales) Organisation, Internal (Producing) Organisation, Patents and Inventions, Technical Education, Publications and Advertisements, and Finance. One of the principal objects of the first of these would be to urge the Government to appoint a Minister of Industry and Commerce, and to carry out various reforms. The sub-committee, in its report, admits that there are in existence somewhat similar organisations with more restricted objects, and makes it clear that it desires co-operation or amalgamation, rather than competition with these organisations. The report is signed by Messrs. W. A. Bristow, J. M. Dale, H. Derwent Simpson, and H. T. Wilkinson.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The accounts of the Guernsey States Telephone Department for the year 1914 shows a net profit of £769 after providing £1,409 for depreciation, £369 for sinking fund, and £287 for special sinking fund.

There have been considerable complaints recently of the working of the Hull municipal telephone system, and, as a result of a long and lively debate at the last meeting of the Corporation, the Telephone Committee was instructed to investigate and report. It is admitted that there have been grounds for complaint, but the main cause is attributed to the diminution in staff owing to enlistments.

A dividend of 8 per cent. is recommended on the ordinary shares of the Automatic Telephone Co. for 1914.

An article in the *Electrical World* (New York) by Dr. L. de Forest describes some recent developments of the well-known hot filament vacuum oscillation detector—named by him the "Audion." He found that if the filament was heated to an unusually high temperature and only a small capacity used in series with the grid, the apparatus behaved as a miniature generator of undamped waves, and a bulb in this condition he terms an "ultraudion." Subsequently, when experimenting with the apparatus in connection with its use as a telephone relay, he found that two such ultraaudions connected in cascade could react on one another; the one would reinforce the oscillations of the other, and if the two were slightly differently tuned a powerful "beat" tone would be produced. Thus the apparatus could be used as an amplifier of received waves and as an exceedingly sensitive detector of undamped oscillations. For this purpose one bulb with a suitable oscillating circuit, however, is usually sufficient. Such a detector has been in use for some months

in the U.S. naval wireless stations at Arlington, at Washington, New York, and elsewhere, and signals from the German undamped wave stations have been received with ease. In addition to telephonic reception, the apparatus has been used for very high speed work by recording the messages on the moving steel band of a telephone and reproducing them more slowly afterwards for transcription. For the purpose the heat pitch of the received signals is made very high, so that the signals are satisfactorily audible when the wire is being run slow enough to read the signals by ear.

ELECTRIC TRACTION NOTES

Motor-omnibus competition with electric tramways is growing up in various forms in different parts of the United States. Particularly in the west small petrol cars carrying from five to seven passengers are being run by irresponsible owners over street routes, and are generally known for some reason as "jitneys," but it is generally thought in electric railway circles that their competition cannot last through financial reasons. Apart from this there is a movement for running electric omnibuses at a slightly higher fare than the trams, for which the attraction is held out that overcrowding is not allowed. The *Electric Railway Journal* also speaks of a scheme for running storage-battery omnibuses in New York in direct competition with all other means of transportation at a 5-cent. fare. These vehicles carry 36 passengers and weigh about 5 tons, including the battery, and have a maximum speed of 18 miles per hour. A motor said to be rated at 2½ h.p. is geared to each of the four wheels. The total costs, including interest and depreciation, are estimated at 21·8 cents (about 10·8d.) per car-mile.

The volume of the Proceedings of the Institution of Railway Signal Engineers just issued shows considerable activity of our Association that is still young, and in its second year numbered 191 members, and is now under the Presidency of Mr. J. Sayers. The following Papers are printed with the discussions thereon: "Characteristics and Efficiency factors of some Typical Electric Signalling Circuits," by Mr. G. H. Crook; and "American Signal Practice as Compared with British Practice," by Mr. A. H. Rudd.

Electric Battery Vehicles.—A lecture on this subject was given by Mr. W. E. Warrilow on Saturday last at a meeting of the Birmingham and District Electric Club. The author dealt principally with commercial vehicles, and said that the field of the electric vehicle was for short distance, moderate speed, frequent stop service, while steam and petrol cars were better fitted for long distance and medium distance infrequent stop service. With regard to the design of chassis, the tendency was to employ a single motor driving by gear or chains on to a differential countershaft, retaining the final side chains, which are fast disappearing in other branches of automobile engineering. He preferred the batteries above the frame rather than underslung. In comparing the alkaline and lead batteries, he enlarged upon the mechanical advantages of the former and the electrical advantages of the latter. The moderate speed of the electric vehicle was a distinct advantage both from the maintenance and traffic points of view. In conclusion, he spoke of the success of the movement in America. In the discussion, Mr. Roberts said that battery tractors might replace horses in quarries, and Mr. W. A. Jackson announced that in view of all the petrol 'buses at West Bromwich having been impressed by the War Office, Edison battery 'buses were about to be employed. These were more costly and slower than petrol vehicles, but the makers guaranteed a saving of £400 per annum in running expenses. If these were satisfactory, they would replace their horse-drawn street-cleaning and dust-collecting vehicles by electric cars. Mr. Walker emphasised the crudity in design of most American electric vehicles, and Mr. R. J. Mitchell explained the constructional features of the Edison battery.

Electrical Canal Haulage.—A scheme of electrical haulage for barges passing through the New Harecastle tunnel of the Trent and Mersey Canal, has recently been inaugurated, and is described in the *Colliery Guardian*. The tunnel is 2,926 yards long, and a steel cable is laid in the bed of the canal, and is made fast a short distance beyond each end. An electrically-worked barge hauls itself along the cable by a winding gear driven through gear by two 15 h.p. Royce motors, either or both of which can be used by a system of clutches. Current is supplied by a 115 cell chloride storage battery capable of a discharge of 150 amperes for seven hours. This barge tows a series of 15 to 18 boats at about two miles per hour. Two such towing barges are provided, and a special charging station has been established containing two 45 kw. sets driven by Campbell gas engines working in conjunction with a gas-producer plant.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS. A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,434.

I wish to recover copper from pickling vats, of which we have a large number, each 9 ft. by 4 ft. by 4 ft. It is desired to deal with the liquid from six such tanks per week. It is proposed to use an electrolytic recovery bath, 4½ ft. by 2½ ft. by 3 ft., with a lead lining, forming the cathode and carbon anodes. What voltage and current density will give the best results, and is the scheme likely to be commercially profitable? The solutions to be dealt with nearly reach saturation.—
"J. L. L."

(Replies must be received not later than first post, Thursday, March 25th.)

ANSWERS TO No. 1,432.

How can one calculate the "whirling" or critical speed of a 5-ft. mild steel transmission shaft 1½ in. diameter without any revolving masses on it (a) when running in plain bearing at each end, and (b) when running in freely swivelling bearings?—"UNIT POLE."

The first award (10s.) is given to "L. R." for the following reply:—

The case (b) having swivelling bearings is best considered first. Such bearings can be taken as merely supporting the shaft at each end, and the critical speed (lowest value) in that case is calculated from the formula:—

$$p \times l^2 \sqrt{\frac{w}{gEI}} = \pi^2$$

where $p = 2\pi n = 2\pi \times$ revs. per second

l = length of shaft = $5 \times 12 = 60$ " in this case

w = load per inch = say 8.18 lbs.

g = 32.2×12 inches per second per second

E = Young's modulus = say 29×10^6 lbs. per sq. in.

I = moment of inertia of section = $\frac{\pi}{64} d^4$

d = diameter = $1.75"$

The proof of the formula is somewhat complex, but is to be found in *ENGINEERING*, 1909, pages 135 and 205 (Vol. 88). Transposing:—

$$n = \frac{60 \times \pi}{2 \times l^2} \sqrt{\frac{gEI}{w}}$$

$$\text{(in revs. per min.)} = \frac{60 \times \pi}{2 \times 60^2} \sqrt{\frac{32.2 \times 12 \times 29 \times 10^6 \times \pi \times (1.75)^4 \times 12}{8.18 \times 64}}$$

$$= 2280 \text{ revs. per minute}$$

This is the fundamental critical speed. The next is four times that value; the third nine times, and the fourth 16 times—progressing as the square of the term.

Case (a), dealing with non-swivelling bearings, is very difficult to solve, because so much depends on the workmanship and like factors. In practice, for purposes of calculation, the bearings are assumed to act as swivelling bearings, because it is found (especially after the brasses have been scraped) that the clearance is such that, as regards vibration, free support is given. It is possible to ascertain the limiting value for non-swivelling bearings by assuming that they "fix"

the shaft at each end. The critical speed in this case is related to that given above in accordance with the ratio $\pi^2/22.37$ —the first value being divided by π^2 and multiplied by 22.37 thus gives the fundamental critical speed in these conditions as 5,150 revs. per min. A closer approximation can be made by considering one end "fixed" and the other supported. In this case one must use 15.41 instead of 22.37. Thus

$$\frac{2280 \times 15.41}{\pi^2} = 3560$$

which is the critical speed on that assumption.

To find the higher values the following figures must be substituted for 22.37:—Both ends "fixed": 61.62, 121, 477.2. One end "fixed" and the other supported: 49.96, 104, 178.

The second award (5s.) is made to "Alpha," who writes as follows:—

The critical speed of a solid shaft running in two bearings, with no overhang and no load other than its own weight, is given in revs. per minute by

$$N = K \frac{d}{L^2}$$

where d = diameter of shaft in inches, L = length of shaft in feet, and K is a constant depending on the material of which the shaft is made and on the type of bearing. For a steel shaft Prof. Dunkerley gives the following:—

(a) When the bearings are of the parallel type, and long enough to fix the direction of the shaft at each end, $K=74,971$, which corresponds to a critical speed of 5,350 r.p.m. in the case in question. Actually the critical speed will be slightly lower than this, since the oil film will prevent a bearing of any normal length from absolutely fixing the direction of the shaft.

(b) When running in freely swivelled bearings, $K=32,864$, giving a critical speed of 2,300 r.p.m. in this case. If the bearings are of a heavy type, comparable in mass to the shaft, this will tend to raise the critical speed, as will also the friction of the bearings on their seats, but the correction will be small if the bearings are light and swivel freely.

It must not be assumed, because the theoretical value of K is given to a high (apparent) degree of accuracy, that vibration trouble will only be experienced at exactly the calculated speed. The critical speed is that at which the time of one revolution is equal to the time of one complete vibration of the shaft, if it is bent slightly to one side and released. This in turn depends on the weight per cubic inch and the elasticity of the shaft, the figures given being averages applicable to ordinary mild steel. The calculated figure is therefore only approximate, but in a simple case like the present it should be within, say, 5 per cent. Further, the corrections for oil film, bearing swivel friction, &c., cannot be given with any degree of accuracy. Apart from this, there will be some slight vibration at all speeds, but if the shaft is initially straight and well-balanced, it is probable that the vibration will not be serious until the critical speed is approached, say, within 10 per cent. of the true value. Above this speed, the vibration will rapidly increase, and at the critical speed it is only limited by the friction of the bearings in their seats, and the molecular friction due to the alternating strains set up in the apparatus. If the speed is further increased, the vibration dies away, but unless the shaft is taken rapidly through the critical speed there is a danger of the vibrations building up to such a pitch as to give the shaft a permanent set, and possibly to break either the shaft or the bearings. If the shaft already has a permanent set sufficient to cause noticeable unbalancing, the vibration will be serious long before the critical speed is reached.

If either end of the shaft in question projects beyond the bearing, "Unit Pole" should consult Prof. Goodman's "Mechanics Applied to Engineering," pp. 493 and 685-7, where various cases are considered, and references given to Prof. Dunkerley's original papers on the subject.

ANSWER TO CORRESPONDENT

WHIRLING.—You will be enabled to solve your further problem on the subject treated above by consulting the references mentioned in these replies.

Russian Equivalents.—A useful card of tables of Russian weights, measures, and money has been issued by the Central Translations Institute (Danes Inn House, 265 Strand, W.C.) at the price of one shilling net.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 11th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

3,191/1. Wireless Telegraphy. G. O. SQUIER. Improvements in the "wired wireless" system of telegraphy, in which the tuning of the line is effected independently of the detector circuit by a variable inductance in the high-frequency bridge in series with the low-capacity condenser, which forms a part thereof. (Five figures.)

3,722/14. Cooking. A. F. BERRY. Electric cooking ovens, &c., in which the heating elements are provided with ribs or fins to increase their effective surface, and guide plates direct the current of air over these fins as it circulates. By this means rapid heating up can be obtained with elements at a moderate temperature. (Five figures.)

3,831/14. A.C. Railways. B.T.-H. Co. (*G.E. Co., U.S.A.*). Improvements in a system of avoiding interference with neighbouring telephone circuits, &c., by connecting the trolley line and return circuit by current transformers; consisting in connection between the rails and middle point of such transformers and reactive connections between the rails and points on the return conductor between the transformers. This is to direct the current into the return current so that its inductive effect more completely neutralises that of the trolley line at every point. (Two figures.)

4,235/14. Lamp Leading-in Wires. B.T.-H. Co. (*G.E. Co., U.S.A.*). A method of covering wires with a coating of a borate to facilitate sealing into glass, and the use of copper-plated iron-nickel wires so coated.

8,821/14. Fuses. B.T.-H. Co. (*G.E. Co., U.S.A.*). Surrounding enclosed fuses with a packing of loose particles of incompletely hydrated metasilicic acid. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Motor control] 4,554/14.

Heating and Cooking: LONDON [Heating apparatus] 4,943/14.

Ignition: MUELLER [Magneton] 4,562/14; JACKAMAN [Sparking plugs] 14,558/14.

Incandescent Lamps: REGNART [Incandescent lamps and connectors] 4,934/14; VICE [Lamp locks] 4,964/14.

Instruments and Meters: CAMBRIDGE SCIENTIFIC INSTRUMENT CO. and APTHORPE [Resistance thermometers] 20,248/14.

Switchgear, Fuses, and Fittings: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Thermo-electric regulators] 4,472/14; JAMES [Thermal switch] 4,618/14; SCOTT [Sign flashers] 4,798/14; ST. HELENS CABLE & RUBBER Co. and WHITE [Switches] 5,069/14; ROSLING, NICHOLS and W. T. HENLEY'S TELEGRAPH WORKS Co. [Fuse boxes] 5,359/14; B.T.-H. Co. and WEDMORE [Protective devices] 5,455/14; TEASDALE [Pendants] 12,746/14; TUCKER [Switches] 14,548/14.

Telephony and Telegraphy: WESTERN ELECTRIC Co. (*Woodward for W.E. Co., U.S.A.*) [Meters for automatic telephones] 5,115/14; GIRARDEAU and BETHENOD [Spark gaps] 14,884/14.

Traction: CHRISTMAS [Motor-car lamps] 4,655/14; THOMPSON [Communication with trains] 5,903/14; MULLANEY [Electric railway systems] 19,944/14.

Miscellaneous: GRATZE [Electric horns] 4,747/14; FYSON [Contact breaker] 5,890/14; NOVITAS FABRIK ELEKTRISCHER APPARATE A.G. [Automatic apparatus for lighting and extinguishing gas lamps] 6,159/14; BIBOLINI & RIBONI [Electrostatic separators] 7,274/14; SOC. ANON. LE CARBONE [Connections] 8,695/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS: LAMMIE, 2,535/15.

Incandescent Lamps: [Filaments and mounting] 17,023/14.

Miscellaneous: FR. KRUPP A.G. [Sparkless circuit breaking] 2,462/15.

Applications for Suspension

10,457/06. B. HOPFELT; 2,711/10, 20,634/10, 9,941/11. SPECIAL FABRIK FÜR ALUMINIUM SPULEN & LEITUNGEN G.m.b.H. (Berlin) and 27,651/12. J. LOEWENTHAL. Aluminium Conductors.

Applications by G. H. Wilson, trading as the Manchester Armature Repair Co., for the suspension of these enemy-owned patents, will be heard on March 23rd. All relate to the manufacture of coils of aluminium wire with the only insulation between turns consisting of a film of oxide or other aluminium salt on the surface. In the last-mentioned, a film of aluminium compounds is electrolytically deposited on a conductor of other metal.

Amendment Allowed

11,886/13. **Commutator.** C. ZENK. Certain verbal alterations have been allowed in this specification, which is for a process of constructing commutators with a centre of moulded insulating material.

Opposition to Grant of Patents

Grants have been allowed on the following specifications in spite of opposition:—

14,524/13. **Telephony.** W.AITKEN. This specification describes a complete system of semi-automatic telephone working.

19,443/13. **Winding Engine Control.** B.T.-H. Co. and R. D. GRIVEN. This is for a system of controlling three-phase winding motors by liquid rheostats with variable liquid level, in conjunction with a pneumatically-actuated reversing switch. A separate tank is used for each direction of rotation of the motor.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

6,107/01. **Meters.** A. C. HEAP and W. O. SMITH. A motor meter in which the fixed coil is spherical in shape, and the moving coil is mounted outside and close to the fixed coil.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, AND TRANSFORMERS: R. BRAUN [Single-phase motors] 24,106/05; B.T.-H. Co. and F. H. CLOUGH [Protection of coils in slots] 25,834/07.

Switchgear, Fuses, and Fittings: W. LAMBERT [Lamp-holders for ship lighting] 23,915/01.

TRACTION: H. LEITNER [Train lighting] 25,784/04.

MISCELLANEOUS: C. R. JAY [Electric rivetting machines] 25,518/08.

Steel for Permanent Magnets.—In a Paper recently read before the Physical Society, Prof. S. P. Thompson discussed the criteria which had been proposed for steel for permanent magnets. Whatever the form of the magnet, he said that the prime requisites were large remanent magnetism and high coercive force, and, since Hopkinson's determinations of 1885, it had been supposed that for the purpose of making permanent magnets the best material would be that for which both of these quantities and, consequently, their numerical product, should be as high as possible. Recently Mr. J. A. Mathews and, independently, Mr. J. R. Ashworth, had proposed to take the ratio instead of the product of these quantities. He produced a table of such figures for a series, showing that the use of the ratio as a criterion of magnetic usefulness leads to most absurd results. As an example, annealed manganese steel (almost non-magnetic) should, judging from the ratio, be six times as good as Remy steel, whereas in reality, for equality of pull, a magnet of manganese steel would require to be 312 times the weight of that made of Remy steel.

The Electric Vehicle.—The second issue of the official journal of the Electric Vehicle Committee contains several articles regarding the use of electric vehicles in public service, and successful examples are referred to in a tower wagon at Ilford and a van which is used for a number of purposes by the West Ham Mains Department. An interesting article by Mr. W. H. L. Watson deals with the way in which the central station engineer can help in the pioneering work of introducing electric vehicles, and Mr. R. Rankin describes an overload detector for traction batteries. Among the many interesting items of information we note that the South Shields Edison battery omnibuses are about to be impressed into Army service. These will be, we believe, the first electric vehicles to "join the Colours." An illustrated supplement gives a most effective view of an American electrically-propelled fire-engine.

"ELECTRICAL ENGINEERING" TRADE SECTION

THE CHOICE OF REFLECTORS

LAST week we had an opportunity of seeing, at Mazda House, a very large variety of "Mazdalux" reflectors which have been standardised by the British Thomson-Houston Co., Ltd. So numerous are the different patterns that the purchaser would experience an *embarras de richesse* in making his choice of the most suitable for his requirements, were it not for the fact that the company assist him by placing at his disposal an extremely useful pamphlet, explain-

outside; steel with similar finish; and steel with white vitreous enamel both inside and outside. There are also eight styles of caps or housings (four of them already fitted with all porcelain holders).

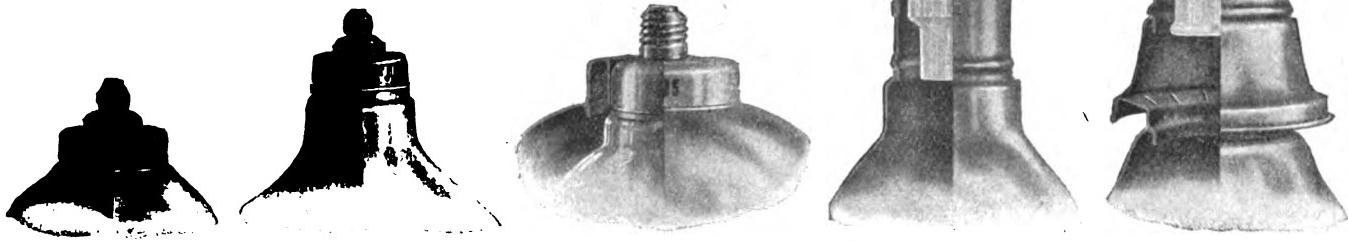


FIG. 1.—SOME OF THE TYPES OF CAPS AND HOUSINGS.

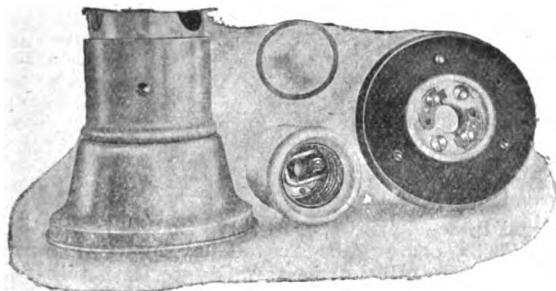


FIG. 2.—ONE OF THE HOUSINGS DISASSEMBLED.



FIG. 3.—EXTRA-EXTENSIVE REFLECTOR.

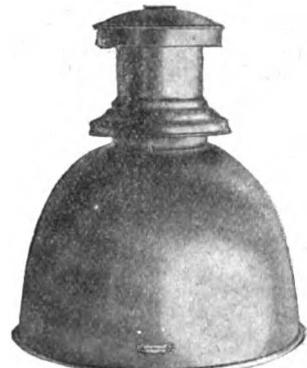


FIG. 4.—DITTO FOR $\frac{1}{2}$ -WATT LAMPS.

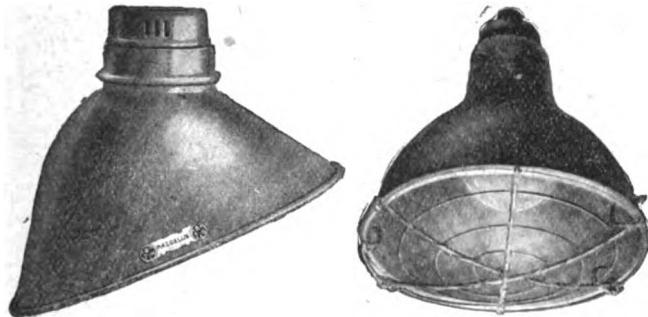


FIG. 5.—15° ANGLE TYPE. FIG. 6.—SPECIAL LOCAL LIGHTING TYPE WITH WIRE CAGE.

ing the uses of the various types, and including a chart which gives the correct size of lamp for different spacings and uses, and the height above the ground at which each class of reflector should be placed.

The new types of "Mazdalux" reflectors differ from the older types in the housings (see Fig. 1), and the fact that they have been developed to include half-watt types throughout the range; and, from what has been said, it is evident that, no matter what industrial lighting condition may arise, there should be one or more out of the many varieties of "Mazdalux" reflectors which will exactly suit the needs. In the first case, the reflectors are available for lamps ranging from 10 to 3,000 candle-power, and for each size of lamp there are reflectors for ten different forms of distribution, viz., dispersive V.E., extra extensive, extensive, intensive, focussing, concentrating, 15 deg. angle, 30 deg. angle, 45 deg. angle, 90 deg. angle. There are also special types for local lighting of machine tools, &c., and also ceiling fittings. The reflectors are made in three classes, i.e., aluminium with special aluminium and matt reflecting surface and French-grey enamel

We are informed that the "Mazdalux" reflectors are entirely made in this country.

Figs. 3, 4, and 5 illustrate three of the most useful patterns, and Fig. 6 is a reflector with a wire guard designed to take a seal which prevents either the lamp or reflector from being tampered with.

AN ELECTRIC TURRET CLOCK

THE first electric turret clock to be purchased by the Post Office has just been supplied by Gent & Co., Ltd. (Leicester), to the G.P.O. at Birmingham, and is placed on the bridge connecting the new and old portions of the building. It is bolted to the face of the bridge, the dial being 5 ft. in diameter, and provided with twelve distinguishing marks in lieu of the ordinary Roman characters, as advocated by the late Lord Grimthorpe. It is arranged for internal illumination, which is provided by electric lamps within a reflector, disposed behind the dial. The clock is fitted with the firm's well-known "waiting-train" movement, the small amount of current for which is taken from the accumulator in the building, which has been installed for general purposes. The "waiting-train" mechanism is under the constant control of a master clock, and control is effected by the half-minute impulses in a simple manner, dispensing with contacts or additional batteries. The hands are exposed directly in the open, so that a clear reading of the dial is obtained under all conditions, and glare and reflection from a glass cover are avoided. The great power which the "waiting-train" movement holds in reserve renders a covering glass unnecessary. The power produced by this mechanism is in direct proportion to the load put upon it, so that the hands cannot be stopped by snow or the most severe gales. A few weeks ago Londoners were much concerned to find all their public clocks stopped or otherwise affected by the heavy gale that swept over the metropolis,

even Big Ben being half an hour slow, St. Paul's clock being stopped at 6.16, while the Fleet Street clocks at 1 p.m., commencing with the Law Courts and going eastward, read 9.26, 9.50, 12.58, 1.5, and 12.47 respectively. The clock supplied by the company to the Royal Liver Building, Liverpool, which is the largest in the world, is worked on the same "waiting-train" principle, and we are informed that, despite many gales and snowstorms, it has kept excellent time since it was started in 1911.

LAMP STANDARDS OF INSULATING MATERIAL

WE illustrate here two forms of portable standard lamps recently introduced by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), in which all metal parts that might come in contact with live conductors are fully protected by insulating material. These are intended for workshop purposes, and, owing to their insulation, are quite in accordance with the Home Office recommendations without any earthing connection. Fig. 1 shows a bench standard (Patent No. 5,418/11) of strong insulating material, with the few metal parts entirely insulated, while the holder is enclosed in a fireproof insulating "Coates"



FIG. 1.—"INSULAH" BENCH STANDARD.

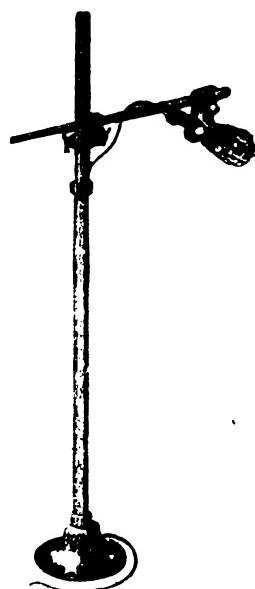


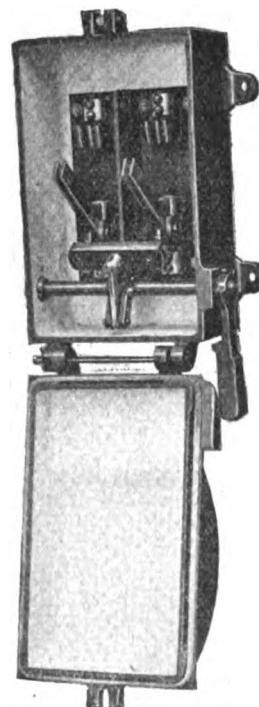
FIG. 2.—"INSULAH" FLOOR STANDARD.

shield of the well-known pattern. The floor standard shown in Fig. 2, made under the same patent, is of substantial construction, and stands about 5 ft. high. The stem is of ash wood fitting into a heavy cast-iron base. On the stem slides an adjustable metal collar. The transverse ash wood rod is attached by a metal clamp to the upright stem, and at the extremity a wooden clamp holds a G.E.C. fibre insulated hand-lamp of strong construction to withstand rough usage. Neither on the stand nor in the hand-lamp are metal parts which can come in contact with current-carrying wires.

ELECTRIC VEHICLE CHARGING SIGNS

THE General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.) have been appointed official manufacturers to the Electrical Vehicle Committee of the Standard Design of Illuminated Box Sign for Charging Stations, and for garages where charging facilities are provided. The sign, wired complete, with terminal box, can be arranged for bolting to the face of a wall or supporting from the usual type of bracket. This sign is described in a leaflet which the company has issued. The case is of best quality stove enamelled iron, black outside and white inside. The panels are formed of a front sheet fired with red and white permanent colours, backed by a sheet of clear glass, suitably

attached. Several standard sizes are made in the following patterns:—Swing pattern, with rings suspending from bar or bracket; post pattern, with wrought-iron clips for clamping end-on to lamp-post; end-on wall pattern, with backplate for screwing or bolting to wall; and flat-on wall pattern, with lugs for screwing or bolting to wall.



AN IRONCLAD SWITCH

OF late years there has been too great a tendency in the design of small ironclad switches to sacrifice everything to cheapness. Bases have often been made of porcelain, which has an unfortunate habit of cracking readily; brass parts have been skimped and rated far in excess of their proper current-carrying capacity; hinges have been depended upon for carrying the main current; coupling bars have been far too fragile, and operating spindles badly adjusted and far from rigid. The switch illustrated is made by Simplex Conduits, Ltd., and has been designed to obviate these defects. The switch parts are mounted on slate bases, and the case has an insulating lining, and a thick rubber gasket between the cover and the case. The cover cannot be opened when the switch is in the "on" position, nor the switch closed whilst the cover is open. It is put on the market in the 80-ampere size at the moderate price of 19s.

AN EFFECTIVE LAMP ADVERTISEMENT

THE signal in semaphore code shown below can easily be deciphered by our readers by the key in the margin. Having done so, they will not be surprised to learn that the



design is reproduced from a postcard which is being issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) for the use of contractors, whose names can be overprinted on the other side.

CATALOGUES, PAMPHLETS, &c., RECEIVED

CAB-TYRE SHEATHED CABLE.—The St. Helens Cable and Rubber Co., Ltd. (Warrington) have issued an interesting booklet, which they will be glad to send to any of our readers, giving experiences of actual users of their well-known "C. T. S." cables. Success is reported in the fields of general wiring work, engineering works, iron works, for portable apparatus in various situations, in chemical works, for cooking apparatus, lift work, on motor cars, and in other more or less trying circumstances.

ELECTRIC COOKING.—A leaflet from the General Electric Co. (67 Queen Victoria Street, E.C.) gives prices and particulars of the two forms of portable electric cooker which were described and illustrated in ELECTRICAL ENGINEERING, Feb. 4th, p. 52. These leaflets can be overprinted with contractors' names and addresses.

BLOTTER.—We have received from the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), a convenient little signature blotter, which calls attention to the merits of Royal Ediswan drawn-wire lamps.

INSULATING VARNISH.—Leaflets from Chas. H. Blume (The White Building, Fitzalan Square, Sheffield) give particulars of several varieties of insulating varnish manufactured by the firm, including a special heavy-bodied heat-radiating insulating enamel known as "Radiolac."

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

BELTING.—The North British Rubber Co., Ltd. (Castle Mills, Edinburgh), will be pleased to send any of our readers a copy of a booklet which they have produced containing a quantity of information regarding rubber belting.

INDIARUBBER GLOVES.—A leaflet containing prices of a considerable variety of indiarubber gloves, gauntlets, &c., has been issued by L. Andrew & Co. (2 Whitworth Street West, Deansgate, Manchester).

AUTOMATIC TELEPHONES.—An interesting illustrated pamphlet from the Relay Automatic Telephone Co., Ltd. (Marconi House, Strand, W.C.), describes the latest form of the Relay automatic telephone system, which has hitherto been more generally known as the Betulander system and was described in some detail in ELECTRICAL ENGINEERING, Vol. X., p. 399, July 9th, 1914. It will be remembered that this system, which is of Swedish origin, does not depend on electro-mechanical selector switches, but effects the necessary connections, as its name indicates, entirely by means of combinations of relays.

FURNACES.—An attractive illustrated leaflet from Meldrum's, Ltd. (Timperley, Manchester), calls attention to various patterns of refuse destructor furnaces, forced draught furnaces for low-grade fuel, mechanical stokers, &c., made by them.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Batley.—A loan of £6,500 for cable extensions has been sanctioned.

Edinburgh.—Three, six, or twelve months' supply of arc lamp globes and conduit. City Electrical Engineer. March 29th.

Manchester.—A 650-k.w. rotary converter and static transformer is required. Chief Electrical Engineer, March 23rd.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdeen.—Church at Cults. Architects, A. Marshall Mackenzie & Son, 343 Union Street.

Ashton-under-Lyne.—New school.

Barnsley.—New Town Hall. (£22,500.)

Bexhill-on-Sea.—Isolation hospital (£6,500).

Blackpool.—Warehouses in Cookson Street. S. H. Thomas.

Canterbury.—New school.

Cardiff.—Reconstruction of Empire (£20,000).—Isolation hospital (£18,000).—New municipal offices.

Erit.—Extensions to Sanatorium. Borough Surveyor.

Manchester.—Additions to hospital at Withington for Guardians.—Public baths at Barlow Road, Levenshulme.

Nottingham.—Three branch libraries.

Oxford.—New school.

Pontypridd.—Cinematograph theatre and block of shops. Architect, A. L. Thomas.

Reigate.—New infirmary.

Roochdale.—Reconstruction (after fire) of Lagley Spinning Mill.

Taunton.—Sanatorium. Clerk, Somerset County Council, Weston-super-Mare.

Miscellaneous

Australia.—A 150-ton electric revolving floating crane for the Naval Dockyard, Sydney. Director of Naval Works, Navy Office, Melbourne, March 24th. Copy of the specification may be seen at 78 Basinghall Street, E.C.

Dundee.—Twelve months' supply of electrical stores for the Electricity Department. General Manager. March 29th.

Edinburgh.—Six months' supply of electrical fittings for the Midlothian & Peebles District Asylum. Clerk, 19 Heriot Row.

New Zealand.—A 1,500-k.w. generating set and a three-unit exciter is required for the Lake Coleridge Power Scheme. Public Work Office, Wellington, April 30th. Copy of the specification may be seen at 78 Basinghall Street, E.C.

Nottingham.—Twelve-months' supply of electrical sundries for tramways department. Chairman, Tramways Committee, March 22nd.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Blackburn.—A contract has been placed with Messrs. J. H. Tucker & Co. for a twelve months' supply of ironclad switches.

A contract has been placed with Messrs. Venner & Co. for a twelve months' supply of A.C. and D.C. Chamberlain & Hookham meters.

Colchester.—A contract for a twelve months' supply of carbon and metal filament lamps for the tramways has been placed with Messrs. Siemens Bro. Dynamo Works, Ltd.

Colwyn Bay.—Provisional contracts have been entered into for a new power station and refuse destructor. Further progress with the scheme depends upon the attitude of the Local Government Board.

Dover.—A contract has been placed with the B.T.-H. Co. for a 1,000-k.w. turbo-alternator, with self-exciter, condenser, and pumps at £4,725.

London: Hammersmith.—The tender of the General Electric Co. has been accepted for electrical accessories. Nine other firms quoted.—Seventeen tenders have been received for a supply of insulated wires and cables, and that of the General Electric Co. has been accepted.—The tender of Messrs. Ferranti, Ltd., for a supply of 5-ampere, 10-ampere, and 25-ampere meters has been accepted, the respective prices being £2 13s. 6d., £2 16s., and £3 8s. 6d. each.

Middlesbrough.—A contract for a twelve-months' supply of Wotan and Tantalum lamps has been placed with Siemens Bros. Dynamo Works, Ltd.

Southampton.—The contract with the B.T.-H. Co. for A.C. meters is extended for a further twelve months.

Whitehaven.—A contract has been placed with Messrs. Venner & Co. for a twelve months' supply of A.C. and D.C. Chamberlain & Hookham meters.

APPOINTMENTS AND PERSONAL NOTES

Mr. Holdsworth, assistant in the test-room at the Swansea Electricity Works, has taken up a similar appointment at Walsall.

Mr. David Wilcock has been elected to a seat on the board of the Electric Construction Co. to fill the vacancy caused by the death of Mr. William Bulloch.

A switchboard attendant is required at the Wednesbury Electricity Works.

Electrical fitters are required for H.M. Dockyard, Portsmouth.

Mr. Alex. Spencer, a director of G. Spencer Moulton & Co., has been elected a director of the British Westinghouse Electric & Manufacturing Co., Ltd.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £71 5s. to £71 15s. (last week £69 10s. to £70).

Change of Style.—The name of the Betulander Automatic Telephone Co., Ltd. (Marconi House, Strand, W.C.), has been changed to the Relay Automatic Telephone Co., Ltd.

Cable Prices.—In consequence of increased cost of manufacture, members of the Cable Makers' Association have been obliged to advance the prices of rubber insulated cables, wires, and flexible cords by 5 per cent.

Bell Wires, &c.—The General Electric Co., Ltd., announced a 20 per cent. advance on prices of electrolier wires, and bell and telephone wires and cables.

Bankruptcies.—A second and final dividend of 2s. 2½d. in the £ is to be paid in the bankruptcy of J. G. Hilton, Electrical Engineer, 103 Exchange Buildings, Birmingham.

The statement of affairs in the bankruptcy of G. J. Parfitt, Consulting Electrical Engineer, 11 Priory Road, Keynsham, shows liabilities at £4,482, of which £2,025 are expected to rank for dividend. The cause of the debtor's failure is said to be losses in connection with the Bristol International Exhibition, and also loss of business through the war. The official receiver said he did not see any likelihood of getting a dividend for the creditors.

LOCAL NOTES

Brighton: Increase in Charges.—In consequence of the increase in the price of coal, it has been decided to increase the charge for electricity for all purposes by ½d. per unit. The public lighting rate has been increased by ¼d. per unit.

Bury: Extensions Prohibited.—Following out the instructions of the Treasury, Mr. H. R. Hooper, the L.G.B. Inspector, informed the Corporation at an inquiry last week concerning a loan of £12,460 for electrical extension that the proposed work must stand over for the present. It was pointed out that a number of local firms are doing Government work. Fresh particulars of the new works absolutely required to enable Government orders to be fulfilled are to be furnished to the Board.

Hove: 200-volt Supply.—The Council has decided to change over the few 110-volt consumers to 200-volt supply, and to bear the cost of doing so.

Leeds: Defects in Generating Plant.—A report by the Electricity Committee calling attention to the fact that expert advice is to be obtained regarding defects which have appeared in the generating plant recently erected, induced several councillors at the last meeting of the Corporation to ask for further information. It was pointed out that the duplicate sets of generating plant purchased some time ago had worked well for a time, but one of the sets had failed before the term of maintenance had expired, and the contractors had to repair it. The second set subsequently also broke down, and an investigation is now being carried out as to the causes. The contractors, at their own expense, have called in the best experts obtainable, and are doing all they can to remedy the defects.

Leigh.—A scheme involving an expenditure of £10,000 on new plant has been referred back. Arrangements had been made for taking a supply in bulk from the South Lancashire Tramways Co., but the negotiations have failed on the question of price.

Grimsby: Battery Scheme Postponed.—By a margin of

one vote the Corporation has decided to postpone the new battery scheme for six months. The Treasury would doubtless have refused to sanction the necessary expenditure in any event.

London: Hackney.—*Electricity Accountancy.*—The Special Administration Committee has been considering the question of the accountancy of the Electricity Department, and an expert Sub-Committee was appointed to examine the books. The result of this investigation is a recommendation that no alteration be made in the present system of dealing with the accounts of the electricity undertaking by which the general control and supervision of the finance is vested in the Finance Committee of the Council, the accounts being kept by the Borough Treasurer and Accountant as part of the Council's account. It is, however, suggested that a professional accountant should be employed each year to conduct a commercial audit independently of the L.G.B. auditor.

Loughborough: Rateable Value System.—In an endeavour to develop the electric heating and cooking load, a recommendation by the Borough Electrical Engineer that the rateable value system be introduced on the basis of 12½ per cent. per annum and ½d. per unit has been adopted. There was some discussion in the Council, the opinion being expressed that this new policy on the part of the Council will be a serious matter for the gas undertaking.

Manchester: Barton Power Scheme and the War.—One effect of the Treasury prohibition of capital expenditure during the war is to hold up the construction of the new power station of the Corporation at Barton. Urgent representations have been made both to the Treasury and the Local Government Board for sanction to proceed with the work, as so many factories which are depending upon the Corporation supply are extending rapidly. So far the efforts do not appear to have been successful.

Truro.—In connection with the Council's application for a £10,000 loan for electric lighting, the L.G.B. has replied that the present seems hardly a suitable time for raising a loan, and asks for the views of the Council.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Deal and Walmer Gas and Electricity Co.—The Treasury has sanctioned an issue of £10,000 ordinary stock at par. The Company now has the sole right to supply electricity in Deal, Walmer, and Ringwould, and proposes to commence the installation of the necessary plant in 1916. The lists close on March 26th.

Brompton and Kensington Electricity Supply Co.—A final dividend, making 10 per cent. for 1914, is declared on the ordinary shares, the same as in the previous year. The sum of £6,500 is placed to reserve, and £5,625 carried forward.

British Electric Transformer Co.—A final dividend, making 7½ per cent. for 1914, is declared on the ordinary shares, compared with 10 per cent. in the previous twelve months.

County of London Electric Supply Co.—It was stated at the annual meeting on Monday that, in spite of the war, the new business secured last year created a record, and that had the war not taken place, 1914 would have been a year of almost phenomenal prosperity. It was hinted that the directors may find it necessary to increase the price of current owing to the increased cost of coal.

Municipal Wiring.—The Bill of the Doncaster Corporation, in which wiring and fitting powers are asked for, was before the Local Legislation Committee of the House of Commons last week. Clause 129 of the Bill gives the Corporation powers to deal in electric wiring and fittings, but it must not do any wiring work itself except between the main and the consumer's meter. Contracts may be entered into with wiring contractors provided the latter work independently of the Corporation. The Corporation must not sell any apparatus except through a contractor, but fittings and apparatus may be hired. In the latter event, the charges are to be adjusted so that there is no loss. There was no opposition to the clauses. Similar clauses were also passed on Tuesday in the Dewsbury Corporation Bill, and again there was no opposition. One clause gives the power to maintain showrooms and offices in connection with the electricity undertaking. Mr. Knight, of the Board of Trade, suggested that the clause was really unnecessary, as municipalities already had these powers under the general law, and the passing of the clause might throw a doubt upon the powers of other municipalities who had not a special Act. The Committee, however, decided to insert the clause, as they have already done in other Bills in previous sessions.



ELECTRICAL ENGINEERING

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SUMMARY

WE refer further to the position arising out of the L.G.B. having refused sanction to loans for extensions to municipal electricity works, except in special circumstances. A number of letters received from central station engineers on the subject are published (p. 126).

THE wiremen engaged in the rolling stock section of the L.C.C. trams have struck work for an increase of wages from 10d. to 10½d.—Wiremen employed by electrical contractors in London are demanding an increase from 10½d. to 1s. with a 48-hour week (p. 126).

A NEW system of mains-protection, which is shortly to be used at Northampton and also on some of the circuits of the L. & S.W. Rly., is described (p. 127).

THE relative merits of watts and candle-power as a rating of incandescent lamps formed the subject of a discussion at the last meeting of the Illuminating Engineering Society (p. 128).

WE deal with a proposal for assisting to find work for women in the engineering industries (p. 128).

AN agreement with regard to a municipal showroom in Glasgow has been arrived at between the Electricity Department and the Contractors. The terms to the Contractors are favourable, although they do not, in fact, give them quite so much as the I.M.E.A. have offered to do in their Bill. The main point is that the contractors agree to the Corporation selling direct to the consumer, and accept half the manufacturer's discount when they have introduced the consumer—a fair arrangement which has been offered to the Electrical

Contractors' Association again and again, and refused (p. 128).

A STORAGE-BATTERY difficulty is explained in our "Questions and Answers" columns (p. 129).

AMONG the subjects of specifications published at the Patent Office last Thursday are a method of D.C. motor control involving slip-rings for A.C. dynamic braking, a lamp lock, and a method of interlocking alternator field switches and main circuit-breakers (p. 130).

A DESCRIPTION is given of the electrical equipment of a large flour mill (p. 131).

A SERIOUS accident due to the bursting of a flywheel occurred at Cardiff on Sunday night (p. 133).

OUR "Trade Section" contains descriptions of some new switches, electro-medical apparatus, and a suction cleaner (pp. 133 and 134).

JUDGMENT has been given in the dispute with regard to electric light carbons, an incident of which was the breaking into the Foster Co.'s works in the small hours of a Sunday morning and the forcible removal of the carbons in question (p. 135).

A 5,000-kw. turbo-alternator and boiler is required at Hull; electric lighting material by the Victoria Railway Commissioners; water-tube boilers at Edinburgh; motor-generators, &c., at Aberdare; a 400-kw. generating set at Bridgend, and telephone material in Greece.—Stores are required in a number of places (p. 135).

A LOAN has been sanctioned at Coventry, but refused at Tunbridge Wells.—It is thought probable that, after all, there need only be a small increase in the charges for current at Dublin.—An increase of 10 per cent. is to be made at Kingston-on-Thames (p. 136).

A MORTGAGE of £10,000 has been arranged with the Sterling Telephone & Electric Co. on behalf of the War Office.—The Treasury has sanctioned an issue of new capital by the Newcastle-on-Tyne Electric Supply Co.—The Brush Company also anticipates obtaining a similar sanction (p. 136).

Arrangements for the Week.—(To-day) Thursday, March 25th.—Institution of Electrical Engineers. "Telephone Troubles in the Tropics," by W. L. Preece. 8 p.m.

Friday, March 26th.—Royal Institution. Evening Discourse. "Experiments in Slow Cathode Rays," by Prof. Sir J. J. Thomson, F.R.S. 9 p.m.

Tuesday, March 30th.—Association of Supervising Engineers, St. Bride Institute, Fleet Street, E.C. "Intercommunication Telephones," by H. C. Lee. 8 p.m.

Wednesday, March 31st.—Institution of Electrical Engineers. Birmingham Section. University. "Development of Main-line Signalling on Railways," by W. C. Ackfield. 7.30 p.m.

Institution of Electrical Engineers. Students' Section. Discussion on "Application of Electrical Engineering to Warfare—Searchlights and Projectors." 7.45 p.m.

THE RESTRICTIONS ON ELECTRICITY WORKS EXTENSIONS

IN our issue of March 11th, we reviewed the position created by the action of the Treasury, through the Local Government Board and London County Council respectively, in refusing to sanction loans for electricity works extensions, unless definitely required for supplying power for the manufacture of munitions of war.

The position has been made more clear by the issue of a letter by the L.G.B., addressed to all Local Authorities, asking that, as far as possible, all new work should be held up until the end of the war; this request was made on the following grounds :—

1. That new work necessitated the employment of additional labour, and therefore involved competition with the State in the labour market. All kinds of labour is now urgently required, either for service in the field or in the production of munitions of war.

2. That on the successful completion of the war and the consequent release from war service of those at present so employed, there would be a large surplus of labour available, and this could then be employed on extension work, and consequently reduce unemployment in the country.

3. That new work necessitated the employment of additional capital, and therefore involved competition with the State in the money market. All available cash resources should at present be conserved for the purpose of a successful prosecution of war.

It is seen, therefore, that extensions are not discouraged merely to avoid the locking-up of capital, but also in order to enable all the labour available (particularly that employed in engineering workshops) for the manufacture of munitions of war. On the other hand, nothing is likely to be placed in the way of extensions required to enable additional electrical power to be supplied by the electricity works to firms engaged on Government work.

Some further cases as to the treatment of applications for sanction to loans are referred to in our "Local Notes" (p. 136).

We have received a large number of letters on the subject :

Belfast.—Mr. T. W. Bloxam writes us: Mr. Hooper settles the question of connecting new consumers to existing plant by putting it upon the engineer of each undertaking to say just how many more consumers he can supply. The best way will be to fix a date, and give notice that no more applications will be entertained after the period has expired. It would be very awkward to refuse any particular application. Undertakings will, as a rule, have sufficient reserve funds for the extensions of mains necessary to provide load to fill up existing plant, but not to pay for plant extensions and mains. Unfortunately there appears to be a more insistent call than usual for trading undertakings to assist the rates, owing to existing circumstances increasing the charges upon them. If normal extensions of mains are stopped, it is obvious the usual number of cable hands must be reduced.

This undertaking was just at the stage when the addition of further consumers was likely to leave insufficient margin of plant. Tenders were about to be invited for additional plant, when it was decided to postpone the extensions. The effect of the war has, however, reduced the demand on the works, so that the postponement is not serious. We are, however, continuing to connect new consumers at such a rate that the question of fixing a date for the limit must arise sooner or later.

Bradford.—Mr. Thomas Roles writes : The Electricity Department is likely to be considerably affected by the decision. Extensions to our generating plant are now in hand, estimated to cost over £80,000; the greater portion of this plant is either delivered or in course of manufacture. I have received intimation that sanction cannot be granted in respect of such portions of the plant included in this scheme, for which orders have not already been placed.

I am expecting permission to raise a loan to cover all work for mains extensions which has received the approval of the City Council. A number of prospective consumers may have to avail themselves of other means of obtaining power and light, either temporarily or permanently. Providing that all the plant at present on order is installed, we expect to be in a fairly comfortable position during the next twelve months, and for a considerably longer period if our consumers assist us by reducing their demands at times of peak load in the event of a serious plant breakdown. I think there is little doubt that the Committee will decide to continue the practice of putting in services and purchasing meters out of revenue, to enable additional consumers to be coupled up on the present distributing mains. The progressive policy adopted for a number of years past in putting down distributing mains where a revenue of 10 per cent. or above could be shown on the capital outlay is likely to bear good fruit under the present circumstances. With

regard to actual mains extensions, if the estimated revenue bears a high proportion to the capital expenditure, the extension may be paid for out of the reserve fund. The number of cases will be limited, however, as this fund has been very heavily drawn upon in connection with plant renewals. Unless money was urgently needed for war purposes, the Treasury would not have issued such a drastic order, and it is our duty to put aside local considerations for the benefit of national interests.

Bury.—Mr. S. J. Watson writes : For the good of the State there is not the slightest doubt that new work should not at present be proceeded with. In several cases, extended borrowing powers have been granted to render additional power available for the production of munitions of war; but we hope that the war will be over before any extension initiated at the present time can be completed, and until all possible existing means of production have been exhausted, I am not at all sure that this policy is a sound one. The cry at the beginning of the war of "Business as Usual" has, in my opinion, had very detrimental results. It has made many manufacturers continue to turn out goods which, in the meanwhile, might very well have been done without, instead of employing their plant and labour for the purpose of the war. Another exceedingly important point is the fact that previous to the war the most of the loans were obtained on the basis of a $3\frac{1}{4}$ per cent. return. Additional money would now have to be raised, probably on a $4\frac{1}{2}$ per cent. basis. If those who are at present receiving $3\frac{1}{2}$ per cent. become fully alive to the fact that corporations are offering $4\frac{1}{2}$ per cent., they will withdraw their money at $3\frac{1}{2}$ per cent. in order to obtain new loans at $4\frac{1}{2}$ per cent., with the result that the interest on practically all outstanding loans would be forced up. A 1 per cent. increase in the interest payable on all the loans of this Corporation would be equal to an increase in the rates of at least 10d. in the £. Mr. Watson then refers to the policy at Bury in connection with the extensions to the Chamber Hall power station, referred to in our "Local Notes" this week. This decision, he continues, involves the necessity to refuse a supply to any additional large consumers, but although it will tend to arrest development, it can have no very serious consequences. We shall continue to connect up small lighting consumers, but all services and meters are now purchased out of revenue. Although many undertakings, including Bury, have fairly large cash resources in the form of a depreciation or reserve fund, such funds are not, as a rule, sufficiently large to finance a large scheme of extension, and in any case, in my view, it is not desirable at present to use such a fund for the purpose. Let the money be invested in War Loan, and so further the general good of the country. The holding-up of any assistance which may have been given to the rates during the last few years is also, in my view, undesirable. The only result would be that the burden at present carried by ratepayers would be still further increased. The profits of gasworks and tramways will, in many cases, be seriously affected, and, provided the electricity department has made the usual or even an increased surplus, it should be applied as usual to the general good.

A number of other letters have been received, which will be published in our next issues, and further correspondence is invited.

LABOUR TROUBLES Strike of L.C.C. Wiremen

ON Saturday, March 13th, the wiremen employed in the rolling stock section of the L.C.C. tramways struck work to have their minimum wages increased from 10d. to 10½d. an hour. The latter pay is the minimum given by the London Electrical Masters' Association to fully qualified wiremen employed on wiring buildings, and is also the rate that has now been paid by the L.C.C. to men engaged on this class of work (see ELECTRICAL ENGINEERING, March 4th, p. 100), but as this rate was only intended to apply to men working on buildings, and not in workshops, the L.C.C. maintained the 10d. an hour for the wiremen on their rolling stock section. The matter has been considered by a Conciliation Board, and has been referred to a Board of Arbitration. Meantime the men are still on strike. The Highways Committee are reporting to the Council on the whole matter on Tuesday.

The wiremen working for electrical contractors have now sent in their application to the London Electrical Masters' Association for increase of pay from 10d. to 1s. an hour. We dealt with this matter in our issue of Feb. 25th (p. 82). Since the resolution then reported the Electrical Trades Union considered it advisable to call another meeting, when the application presented to the London Electrical Masters' Association for one shilling per hour with a forty-eight hour week was ratified, and it was further decided that a special code of working rules for men engaged on ship work should be circulated to all the employers in the Port of London.

We understand that a reply by the Masters' Association is being sent to the Trades Union.

THE CALLENDER-WATERS FEEDER PROTECTIVE SYSTEM

THE latest automatic feeder-protective system is due to Mr. E. G. Waters, working in conjunction with Mr. J. F. Watson, of Callender's Cable & Construction Co., Ltd. It aims at simplicity of construction and arrangement, independence of pilot-wire circuits, and adaptability. Arrangements have already been made for it to be used at Northampton, and it has also been selected for the lighting and signalling circuits of the L. & S.W. Railway (which are at 3,300 volts A.C.), the main traction feeders for which

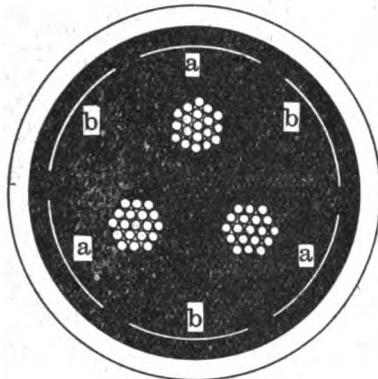


FIG. 1.

are to be protected on the Ferranti-Waters system.* Both systems will thus be given a trial side by side.

The cable used for the Callender-Waters protective system is constructed in the ordinary manner, except that, under the lead sheath, and lightly insulated from it, there are a set of six copper tapes, 0.016 in. thick, put on with a fairly long lay, and not touching one another. The insulation between the adjacent tapes and between the tapes and each is sufficient to withstand 1,000 volts. Fig. 1 indicates the arrangement of the tapes in a cable. In the simplest application of the system, alternate tapes *a* *a* *a* are connected together, and through a relay to earth at one end of the cable, and the tapes *b* *b* *b* are connected together and to earth at the other end. The relay closes the circuit of the tripping coil of the main switch. This is shown diagrammatically in Fig. 2; for simplicity only one main conductor *C* is indicated, and the two sets of tapes and the lead *L* are shown as straight lines. *T* is the tripping coil of the main switch.

If an earth fault appears on the conductor through any cause, say at *F*, contact will be made between the conductor *C*, both tapes, and earth. A circuit will then be made from the conductor *C* through the tape *a* and the relay to earth. This in itself might not be sufficient to actuate the relay, as the circuit is obviously shunted by the direct earth connection to the conductor *C* at the fault; but owing to the tape running parallel to the conductor, a strong current will be induced in it and flow through the circuit, tape *a*,

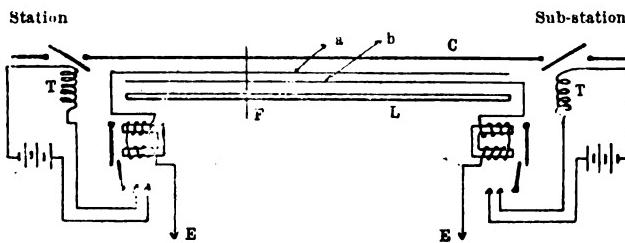


FIG. 2.

relay, earth, and back to tape *a* at the fault, and this is found to be quite sufficient to work the relay. To provide for the contingency of the fault occurring quite near the end of the cable, in which case there would only be a short length for this inductive action to take effect, or if only a comparatively small earth current is allowable before the cable is cut off, some iron is threaded over the part of the cable connecting the metal sheathing to the earth plate or outgoing metal sheathing. This has the effect of increasing the impedance of the sheathing, thus forcing the current through the relay to earth.

The relay at the sub-station end should also be actuated by the circuit made through the tape *b*, and the cable would thus

be disconnected automatically at both ends. There is, however, just a possibility that a fault, say from a blow with a pick, might only connect one tape to earth and not two adjacent ones, in which case the cable would still be left disconnected at one end. To meet this contingency, the connections are modified, in practice, to those shown in Fig. 3, which is the arrangement to be adopted at Northampton and the

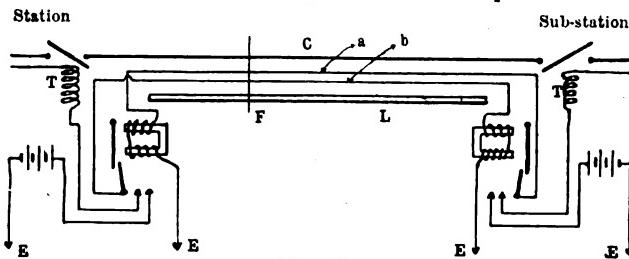


FIG. 3.

L. & S.W. Railway. On tracing these out, it is seen that, as soon as either of the relays operates, besides closing the circuit of the tripping coil of the local switch, it establishes a circuit from the battery, through the unaffected tape and the relay at the other end, and back to the battery through earth. An additional advantage of this, is that there is an electric interlock between the two relays, and the sub-station switch cannot be replaced until the station relay is restored.

The system described is clearly applicable to single or duplicate feeders, and also to interconnectors and ring mains. To protect "swallow-tailed" feeders, a modification is necessary, consisting in connecting the six tapes in three sets of two, instead of two sets of three. The relay is then made with an additional secondary contact for the other set of tapes (connected to the relay at the second sub-station). The operation of any of the three relays will then actuate the other two relays as well.

A further modification has been devised, making the system independent of the induced current in the tape, and also, therefore, making it applicable to a D.C. system, but

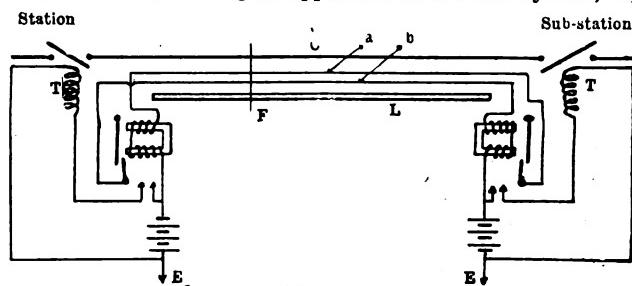


FIG. 4.

an opportunity has not yet arisen for its practical application. The connections are shown in Fig. 4. It is seen that, on connection of either of the two sets of tapes to earth, both relays will be actuated by the batteries; it will also be noticed that these are in opposition, so that while the relays are down the batteries are in opposition and not short-circuited.

We have been privileged to see the Callender-Waters system in operation at Messrs. Callender's works, and were much impressed by its simplicity and quick action.

A Diesel Engine Breakdown.—We have received from the Diesel Engine Users' Association a report by Mr. P. H. Smith on an accident which occurred last September to a Diesel engine at Oxford, when one of the big ends broke up and serious damage was done to other parts of the engine. The accident was traced to fracture of one of the bolts of the big end of the connecting rod, which was of insufficient strength. The stresses in the connecting-rod bolts of various engines have been worked out, and it was seen that the Oxford bolts were stressed much too high. If designed on the lines of a Willans engine, it should have been $\frac{1}{4}$ in. larger, or compared with a Sulzer engine, 1.18 in. larger. Again, the Oxford bolt was of iron, whereas Carels at present, and also Willans, use Siemens-Martin steel, and Sulzer crucible steel. Taking into account the tensile strength of these materials, it would appear that the Oxford bolt had a factor of safety of 7.7, while Willans allow 18 and Sulzer 27. Mr. Smith also goes into the question of the design of the big end, stating that greater stresses are produced in the marine type than when the top brass is contained in a jaw forming an integral part of the connecting rod, as in the Augsburg and Sulzer engines. He recommends that these bolts be replaced after 3,000 hours' working.

* See ELECTRICAL ENGINEERING, June 25th, 1914.

THE RATING OF INCANDESCENT LAMPS

AT the last meeting of the Illuminating Engineering Society, Mr. F. W. Willcox opened a discussion on the practical rating of electric incandescent lamps. He pointed out that in this country, as well as in America, lamps had come to be rated by their input in watts rather than by their output in candle-power, and gave the following among the reasons why it was preferable. Candle-power was in its nature an indefinite and physiological quantity, difficult of measurement, and there was much room for confusion in the difference between the British and German standards, the difference between mean horizontal and mean hemispherical candle-power of a lamp, and the great difference that can be made in its value in different directions by altering the disposition of the filament and adding reflectors. The wattage, however, was definite, easily measured, and did not alter during the life of the lamp as much as the candle-power. It was a more convenient measure for planning installations, estimating costs, &c., and it was easier for the manufacturer to retain his standard watt sizes as the efficiency of the lamps increased than to alter them to fit the old candle-power values. Again, the efficiency of 100-volt and 200-volt metal filament lamps were not quite the same, and it would be inconvenient, as two sets of different voltages would be required to keep the candle-powers in line. The power consumed seemed to the speaker a very natural unit to work on, and only needed to be coupled to the efficiency value to give the luminous output. The efficiency could be measured by matching the colour against standards, and did not necessarily involve candle-power observations. Finally, Mr. Willcox argued that if it was necessary to define the luminous output of a lamp, it was much better expressed in "lumens," or units plus of light, than candle-power, as that gave the total light from the lamp, and was uninfluenced by the disposition of the filament, &c., bearing a constant ratio to the watts for a particular filament temperature. Its use also simplified many illumination calculations, especially in estimating the effect of indirect and semi-indirect lighting.

Mr. Wordingham, who continued the discussion, considered that the watt rating was useless to the consumer and pointed out that the rated candle-power was always understood to be mean horizontal. Prof. S. P. Thompson in a written communication held that lamps should be marked with volts and watts, and, if desired, with approximate mean spherical candle-power, but that for the "ranging of standard magnitudes" specific values of watts should be used. Mr. A. P. Trotter also wrote that he was in favour of watt rating, and his conviction had been strengthened by the use of "downlight" and similar lamps, for none of which horizontal c.p. is suitable. The lumen he regarded as a unit only fit to be handled by experts, and not fit for public use. Several speakers dealt with the parallel problem with gas lamps. Mr. Haydn T. Harrison thought it was absurd to rate light sources in anything but light units; he also preferred candle-power to lumens, and Mr. C. C. Paterson agreed that the primary principle must be that we should try to rate in terms of what the lamp was intended to do. Prof. J. T. Morris and Mr. McIntyre were also strongly in favour of candle-power rating. Mr. J. Y. Fletcher said that manufacturers made no secret of the candle-powers of their lamps and had no great objection to marking it on the lamps if desired, and Mr. Le Marechal considered that although there were some advantages in working in watts, if the public wanted candle-power on the lamps, there was no objection to putting it there. Mr. J. E. Dow and other speakers emphasised the value of polar curves for giving complete information about the output of a lamp.

WOMEN'S WORK IN THE ENGINEERING INDUSTRIES

MISS C. GRIFF, of 52 New Bond Street, W., writes us as "a woman engineer," who has herself been through the orthodox training of workshop apprenticeship, drawing office, and technical college, on the subject of mobilising the women willing to work on war service, as suggested by the Board of Trade. She asks the help of our readers in letting her know in what special work in their factories they are prepared to engage women workers, and whether there is any particular method of training they would desire to fit girls for working for them? Lady tracers and draughtswomen have, of course, been employed to a certain extent for years past, but she wishes to know also what works who have hitherto not employed them will now be willing to do so. She does not wish to add to the numerous existing organisations for women's work, but to assist in the management—under the auspices of one of them—a special branch for training and helping women to work

during the war in the factories directly connected with munitions of war, and other necessary engineering undertakings.

We have made inquiries, and find that there is no organisation which does exactly that which Miss Griff proposes; the Queen's Work for Women Relief Fund, the National Political League, and the Professional Women's Sub-Committee of the Prince of Wales' Fund, all working more or less in conjunction to avoid overlapping, act mainly in the direction of making or finding work for women in distress. On the other hand, we hardly think that there will be much scope for the organisation proposed by Miss Griff, for those firms who can use female workers to take the place of male ones, would doubtless prefer the simpler expedient of first filling the vacancies with those already trained, and if more were required would then advertise for others, select likely applicants, and train them themselves. Moreover, the existing technical classes and schools are for the most part open to women as well as to men, and the fees are not large.

MUNICIPAL SHOWROOMS

Agreement with Contractors in Glasgow

AFTER a conference between a special sub-committee of the Glasgow Electricity Committee and a sub-committee of the Electrical Contractors' Association of Scotland (Glasgow Branch), the following agreement has been arrived at with regard to the proposal by the Electricity Department to establish a showroom in a central portion of the city:—

The proposed showroom would be equipped and managed entirely by the Corporation, on the following lines, for five years from the date of opening:—

That the contractors and their customers shall be afforded all possible facilities for inspecting the stock there.

That any electrical contractor who shall request the Corporation to sell any fittings, accessories, lamps, or apparatus shall be entitled to receive one-half of the discount which he would have received from the makers, had he sold the apparatus direct.

That all fittings, accessories, lamps, and apparatus sold from the showroom shall be at the current list prices of the firms supplying the goods.

That, as far as possible, sales initiated in the showroom shall be completed through the contractor who sent the customer to the showroom.

That all wiring work resulting from inquiries at the showroom shall be done direct by a contractor, and no undue preference shall be shown.

That the hiring of apparatus shall not be undertaken from the showroom, but the showroom management shall be free to lend apparatus for a short period to possible customers under exceptional circumstances, and make a charge for the loan if they think fit.

That all charges made to customers by the showroom management shall be separately stated on the relative demand notes sent to consumers, and all sums paid to and obtained by the Corporation as a result of business done in the showroom shall be separately shown in the annual accounts of the Corporation Electricity Department, which accounts are audited by an independent auditor.

The Electrical Trades Benevolent Institution.—The annual general meeting of the members of this Institution will be held at 6.30 p.m. on Monday, 18th April, at the Institution of Electrical Engineers. Mr. E. Garcke has kindly consented to take the chair.

A Home Office Prosecution.—The Lancashire and Yorkshire Railway Co. were summoned recently at Formby for a breach of the Factory Acts in connection with an accident which took place at their Formby power-house, when a man named Hindley, who was working behind a 7,500 switchboard, received severe burns and injuries. It appears that he had ascended a ladder close to some live connecting-links to measure off a length of cable when, in handing down the cable to another man, he made contact with a live conductor, and was thrown from the ladder and badly burnt. The prosecution contended that the switchboard ought to have been dead before any work was attempted upon it at all, or, if it were necessary to work upon it "alive," it should have been properly and efficiently screened. Screens of a kind were provided at the base portion where the switches were, but no screens suitable or intended to be used for these connecting links were supplied. The railway company's case was that the work to be done had reached a certain stage, and nothing further ought to have been done till midnight, when the board would have been dead. The men in their zeal to get on with the work and in order to make use of the daylight had gone on with the work without having been told to do so. It was admitted, however, that no specific instructions forbidding them to do so had been given. There were no screens for the upper part of the board, as it was never contemplated that it should be worked on when live. The Bench held the company responsible, and imposed a fine of £20 with £20 costs.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

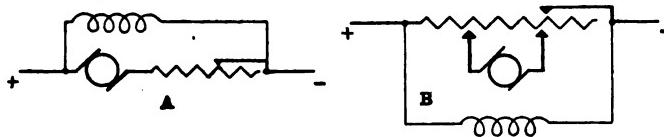
RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,435.

I wish to drive a milling cutter taking $\frac{1}{2}$ h.p. at 30 revs. per min. by means of temporary D.C. 15-h.p. motor which normally runs at 750 revs. Is it possible to reduce the speed of the motor to 30 revs., and will the speed remain fairly constant when the cutter is working, if a resistance is used in series with the



armature (with full excitation) to reduce the speed? I do not want to use reducing gear. Are there any other ways of reducing the speed without altering the motor internally? Would it be better to shunt the armature across a resistance as in diagram "B" instead of series connection as in "A" to give constant speed—"E. W."

(Answers must be received not later than first post Thursday, April 1st.)

ANSWERS TO No. 1,433.

I am in charge of an accumulator battery. One cell gives me plenty of trouble. Its peculiarity is that the specific gravity falls during charging, and recovers during the discharge. The plates are in good condition, and have a clearance of 6 in. between lower edges of plates and bottom of cell, which is a teak lead lined tank. There are no shorts in the cell, and the sediment was taken out to be sure that there was no fouling due to it. The battery is not yet three years old. The sulphuric acid was 1·840° S.G. before mixing with the distilled water, and when mixed the electrolyte was 1·180 S.G. There is also no temperature variation in the battery room during the charge. What is the probable cause of the trouble?—"H. C. P." (Hong Kong).

The first award (10s.) is given to "M. M." for the following reply:—

The cell giving trouble has evidently become reversed in polarity, but the cause of such reversal is difficult, if not impossible, to give with certainty; only suggestions can be offered. We will take for granted that the cell is properly connected to the adjoining cells. This can easily be checked by counting the number of plates, the negatives being one more in number than the positives.

Consider now how a cell could have its polarity reversed. Suppose a pellet of paste short-circuited the plates, or, again, some substance from outside might lodge across the plate and run the cell down. If this occurred during "charge," this particular cell would be practically cut out; therefore the specific gravity of its acid solution would remain at about 1·180. If we further suppose that by some means this bridging substance became dislodged, then when battery was "discharging," the current passing through the cell would change its polarity. The "short," as above suggested, would mean some time before cell was in good condition again. This is evident when we remember that in charge and in discharge there is not a very great difference in the ampere-hours.

The method of procedure would be to see that the cell is clean and free from deposit and that the plates are well separated; also that there is not a loose plate nor loose paste. Another point is to make sure that the plates are clear from the lead lining of containing vessel. For several discharges cut this cell out, cutting it in again for the charge; this will soon put matters right.

It is the passage of the current through a cell that, when charging, raises the specific gravity of the acid solution by the "withdrawal" of water. Oxygen goes to the positive and hydrogen to the negative plate. The polarity of a secondary cell

is not a fixed quality, but is determined by the direction of the flow of the charging current. A cell, therefore, that is without a charge has its polarity altered by the general discharge current flowing through the battery. A cell under such conditions would have the specific gravity of its acid solution increased, although that of the other cells of the battery was decreased. The voltmeter should not only give the actual potential of a cell, but also indicate its polarity. Also the dark red colour of positive plates usually makes polarity at once obvious.

The second award (5s.) is made to "L. R." who writes as follows:—

The exact cause of the difficulty mentioned cannot readily be determined because the fault may be due to one or two matters. Quite likely, as the cell has been giving trouble at some course of its existence, it has been reversed probably by continuing discharge through the whole battery after the E.M.F. of that particular cell has dropped to zero. In this case the plates ultimately would look quite healthy, because in a subsequent charging and discharging as regards their surface they would obtain the right colour, but internally the composition would not be correct. In these circumstances they would to some extent behave like plates which have not been completely formed, and it is well known in practice that with such plates there is a drop of specific gravity of the electrolyte during charge. The reason is not fully understood, but it is probably due to a chemical action which goes on within the plate itself. It may be that the plates were not properly charged in the first place after receipt. A large amount of lead sulphate is usually put into the plates, especially for transit abroad, because the paste holds better in this way. In these circumstances they should be very fully charged on arrival, and if the original charge is not complete the ultimate composition of the plate is very much a matter of doubt. It takes 300 to 400 hours charging and discharging properly, before the plates are fully formed and the specific gravity of the electrolyte becomes thoroughly stable.

Another possibility is that the plates, either through their construction or subsequent treatment, have become unduly hard and diffusion of electrolyte is slow. This will result in slow increase of density within the plate during charging, the strong acid there formed not diffusing out until discharge takes place, where it ultimately raises the specific gravity of the rest of the electrolyte so that the total gravity is increased on discharge. The reverse action occurs in charging. This is particularly noticeable if charging and discharging are effected rapidly, and there is little time left between.

The history of the cell should be examined from both the above points of view. In addition, it should be made certain that there is no local short-circuit formed by dropping particles, because this tending to reduce the E.M.F., and, therefore, to effect reversal, will contribute to the first-mentioned cause. It is not likely that impurities in the acid give rise to the faults suggested, because presumably the same acid has been used in all the cells. It is suggested that the cell in question should be fully charged with the others, allowed to stand for some little time, then the density taken and the acid adjusted to the correct strength. It might then be worked less heavily than the rest of the battery, but should be given full and very careful charges, when the difficulties found will probably disappear. Matters will most likely be assisted if 1 per cent. of sodium sulphate be used with the electrolyte, particularly if the battery has suffered previous reversal.

QUESTION No. 1,429.

"M. J. L." asks me, in your issue of March 11th, why I assumed that the rotor voltage on open-circuit of a 20-h.p. 550-volt three-phase motor would be approximately 200 volts. I have pleasure in replying as follows:—When designing a rotor, two of the main points to be kept in view are safety and cheapness, and for small motors, when the stator pressure is not very high, it is found that the most economical design gives a slip-ring pressure on open circuit, i.e., when the motor is standing still, of from 150 to 250 volts.

In large H.T. induction motors, the rotor E.M.F. is designed to be 400 to 500 volts or even higher at starting, in order to avoid large currents necessitating heavy rotor windings, massive slip-rings, brush gear, &c. "M. J. L." is correct in stating, "with the rotor standing still . . . the cutting of the lines of force would now be at the greatest rate," but when the rotor is standing still the motor may be regarded as an ordinary transformer, although, of course, a very inefficient one, due to the air-gap and to the fact that primary and secondary windings do not interlink, and the open-circuit voltage between the slip-rings will depend on the stator voltage and on the ratio of stator to rotor windings. Generally speaking, where both stator and rotor windings are similarly connected:—

Open-circuit slip-ring voltage =

$$\text{Stator volts} \times \frac{\text{No. of rotor turns in series per phase}}{\text{No. of stator turns in series per phase}}$$

With regard to the rotor currents, these may be fairly high without requiring high rotor E.M.F.'s, as the resistance of a rotor is usually a fraction of an ohm, and the external resistance will only be a few ohms. I trust this explanation will clear up any points "M. J. L." may be in doubt about regarding rotor E.M.F.'s and currents.

"C. S. B."

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 18th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

4,554/14. **Motor Control.** B.T.-H. Co. (*G.E. Co., U.S.A.*). A system of motor control in which dynamic braking of a D.C. motor is effected by allowing the armature to generate alternating current in a special circuit from slip-rings provided in addition to the commutator, while the fields are separately excited. (Three figures.)

4,934/14. **Strip Lighting.** C. C. REGNART. A system of strip lighting by tubular straight filament lamps with terminals at each end. The lamps are arranged to be very close together by the use of cup-shaped terminals sunk into the glass. (Three figures.)

4,964/14. **Lamp Locks.** J. A. VICE. A thin metal sleeve over the lamp cap with hole for the pins to project through has an angular cut in it so that a part of it can be turned up to form a springy ratchet tooth which engages the slot in the holder when the lamp is in place, and prevents it being turned back for removal. A special tool has to be used to cut away this tooth to withdraw the lamp. (Five figures.)

5,455/14. **Protective Apparatus.** B.T.-H. Co. and E. B. WEDMORE. A protective device for alternators comprising a field switch arranged to be tripped only when the relay controlling the main circuit-breaker has acted and movement of the main switch has actually commenced. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: HOLM-HANSEN [Transformers] 5,511/14.

Incandescent Lamps: OWEN and DAMEY [Incandescent lamps] 6,853/14.

Instruments and Meters: MILNE, GEORGE, LEVY and TUCKER [Electrical measurement] 26,929/13.

Switchgear, Fuses, and Fittings: B.T.-H. Co. (*G. E. C., U.S.A.*) [Switches] 2,089/14; CHALIER [Lamp-holders and reflectors] 4,627/14; SANTOSTEFANO DELLA CERDA [Luminous switches] 10,733/14; WORSNUP [Switches] 19,122/14.

Telephony and Telegraphy: SMITH [Signalling] 6,668/14; GOLD-

SCHMIDT [Wireless selector] 14,595/14; OLSSON and PLEIJEL [Loading coils] 22,270/14.

Traction: WARTHEN [Train-control system] 5,351/14.

Miscellaneous: KLAHN [Gyroscopic compasses] 29,010/13; WEST [Battery cases for motor-cycles] 4,470/14; CADENEL [Electrically-controlled locks] 5,354/14; J. P. HALL & Co. and NIELD [Electric brakes, clutches, &c.] 5,583/14; BURNSIDE and WALLACE [Condensers] 5,583/14; COLLIE [Fans] 6,867/14; GILES [Condensers] 11,404/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTOR TRANSFORMERS, &c.: LAMME [Polyphase motor control] 2,329/15; TORNER [Transformers] 2,786/15.

Switchgear, &c.: OTTINETTI [Push-button switches] 2,787/15.

TELEGRAPHY AND TELEPHONY: GIRARDEAU [Spark gaps] 15,031/15.

Traction: CONNET and ANR. [Vehicle lighting] 3,014/15.

Miscellaneous: HEINSOHN [Welding] 2,248/15.

Expired Patents

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A. J. PETERSSON [Producing arcs] 25,287/05; BECK FLAME ARC LAMP CO. (*Deutsche Beck Bogenlampen Ges.*) [Flame arc lamps] 26,420/07; G. JOBSON [Reflectors for arc lamps] 28,358/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: R. P. JACKSON [Protective system] 26,120/08.

DYNAMOS, MOTORS, AND TRANSFORMERS: C. E. L. BROWN [Turbo-alternator field magnets] 24,632/01; LANCASHIRE DYNAMO CO. and MOTOR CO. and R. S. MCLEOD [Frequency changers] 26,198/08.

Electrochemistry and Electrometallurgy: C. BINGHAM [Electric furnaces] 26,356/08; P. BUNET and A. BADIN [Electric furnaces] 26,225/09.

Heating and Cooking: M. MARZETTI [Water heaters and coffee pots] 28,480/09.

Ignition: K. SCHAFFLER and D. WEISS [Magneto exploders] 27,318 A and B/06; NEW IGNITION SYNDICATE and H. FOSTER [Battery terminals] 26,367/08.

Switchgear, Fuses, and Fittings: A. WEST [Fuses] 26,251/08.

Telephony and Telegraphy: SIR O. J. LODGE, A. MUIRHEAD, and E. E. ROBINSON [Vacuum tubes] 25,047/05.

Traction: A. BROWN and L. W. CROSTA [Electric rail grinder] 24,682/05.

Miscellaneous: R. C. SMITH [Electric lifts] 26,165/03; R. MAROT [Germicide apparatus] 14,372/04; T. H. PARSONS and A. E. J. BALL [Relay switches for clocks] 27,445/06; SHIP CLEANING CO. and W. R. MACDONALD [Electro-magnetic ship cleaner] 26,441/07; A. A. C. GESE [Electric cranes] 28,367/09.

vehicles, the Committee have decided to recommend, as standard for electric vehicles, the lamps of the size and voltage recommended by the Engineering Standards Committee. These lamps are for a pressure of 12 volts, and the Committee recommend that, for the present, they be coupled across such a number of cells as will give the required voltage, and that a special extra terminal be provided on the cells for this purpose. The Secretary was directed to write to those London municipal and company undertakings charging more than 1d. per unit for "off peak" supply, expressing the hope that they will reconsider this matter and come into line with the large number of supply undertakings which have already adopted the Committee's Standard Tariff.

Induction Generators.—A paper on this subject by Mr. W. H. Date was read at a meeting of the Students' Section of the Institution of Electrical Engineers on March 17th. The author described such a machine as an induction motor mechanically driven above synchronism, and explained that its terminals must be connected to a circuit of definite frequency, as it is not self-acting. In some railways induction motors acting in this way were used for regenerative braking on down grades, and he suggested that the practice might be extended over a greater range of speed by pole-changing switches. Various experiments with induction generators were described, and it was remarked that ordinary alternators when fitted with amortisseurs could act as induction generators when the excitation was accidentally removed, and could continue to run in parallel without damage. The phase relations of the current were discussed, and it was shown how induction generators had advantages over synchronous machines in absence of synchronising and limiting difficulties. Their construction was also more robust, and they were particularly suitable to turbine speeds. The author suggested that a station equipped with these machines running in parallel with synchronous motors would be cheaper to instal and would possess considerable advantages over a station employing synchronous generators.

ELECTRIC TRACTION NOTES

On the suggestion of Sir John Snell, who has been advising the Corporation concerning the proposed purchase of the Bristol Tramways and Carriage Co., independent valuations are to be obtained from Mr. C. P. Sparks, Mr. Peter Addie, City Surveyor, and Mr. L. S. McKenzie, City Engineer.

The Aberdeen Corporation has decided to abandon the "pay-as-you-enter" tramcar system.

The accounts of the Metropolitan Electric Tramways, Ltd., and the London United Tramways, Ltd., for 1914, both show considerable reductions in traffic receipts, the figures being £8,510 and £11,658 respectively. Consequently, the Metropolitan Electric Tramways Co. pay an ordinary dividend of 2 per cent. compared with 3 per cent. last year, and the London United Tramways Co. ½ per cent. on the preference shares as against 1 per cent. last year.

The Electric Vehicle Committee.—At a recent meeting it was decided to make the main feature of the June issue of *The Electric Vehicle* "The Municipal Uses of Electric Vehicles." A slight increase in the demand for Publicity Mail Cards was reported. As we have already announced, the General Electric Co. has been appointed the official manufacturer of charging station signs for twelve months from April 1st for the illuminated type of sign. The Patent Enamel Co., of Selly Oak, Birmingham, has been appointed the official manufacturer for the same period for the enamel plate type of sign. As to the standardisation of metal filament lamps for use on electric

AN ELECTRICALLY DRIVEN FLOUR MILL

THE drive of a flour mill presents certain special features. In the grinding department, which requires most power, the different machines are so proportioned that the whole mill operates as one huge machine with a continuous process of manufacture, and complete interdependence exists between

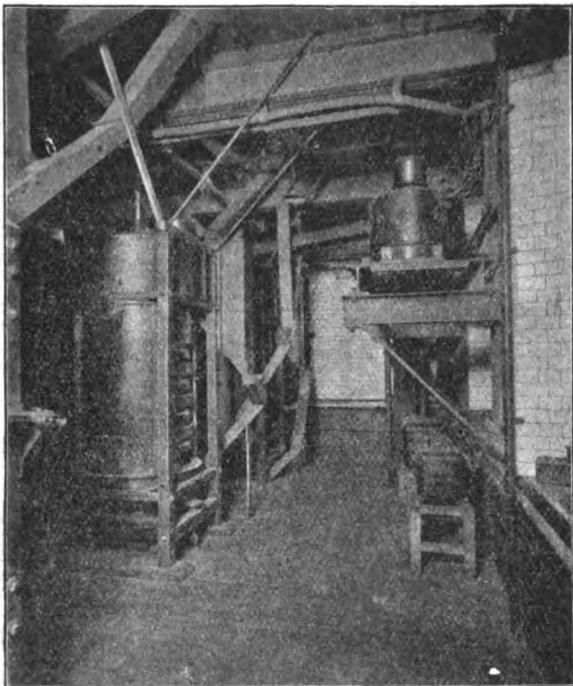


FIG. 1.—GRAIN SCRUBBING MACHINE DRIVEN BY
10 H.P. MOTOR.

the various sections. In other portions of the mill many machines are more widely separated and intermittent in operation. Owing to the big capital outlay in machinery and the relatively small amount of labour required, it is a frequent practice to run mills night and day with a break only at the week end, with the result that the demand for power is uniform, and lasts for long and uninterrupted periods. A vital consideration is that the quality of the product is very susceptible to variation in treatment, which includes, as an important factor, regularity of speed. This

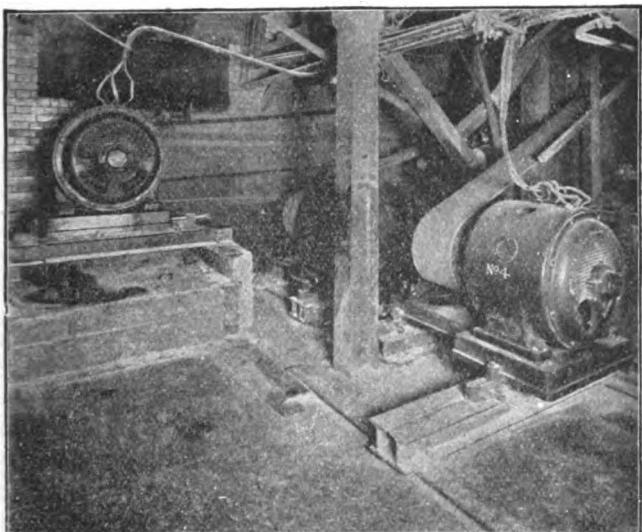


FIG. 2.—40 H.P. MOTOR DRIVING LINE SHAFT
FOR ROLLER MILLS.

constancy of speed is a virtue of the electric drive which is usually appreciated by millers, but in addition there are other material advantages. The light is almost invariably electric, as an open light is impossible owing to the explosive nature of the flour dust, and the elevators and intake plant are

usually driven electrically, so that an electrical installation of some kind must be laid down. Again, electric drive permits of a much more convenient arrangement of the machinery, as it need not all cluster round the line shafting. The ease with which the actual power taken can be measured at any time also greatly facilitates the detection of blunt rolls. Lastly, with the constancy of speed obtainable with electric driving, an increased output of at least 2½ per cent. is available, and the better quality of the product commands a higher price.

An example of a large flour mill converted to electric drive is the Silvertown Flour Mill of the Co-operative Wholesale Society, Ltd. This mill has been electrically equipped by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.). It was originally driven by three steam engines, but following the success of the electrically-driven flour mills of the same company at Newcastle, arrangements were made for the supply of power by the West Ham Corporation, who installed a pair of two-phase oil-insulated transformers, and equipped a sub-station

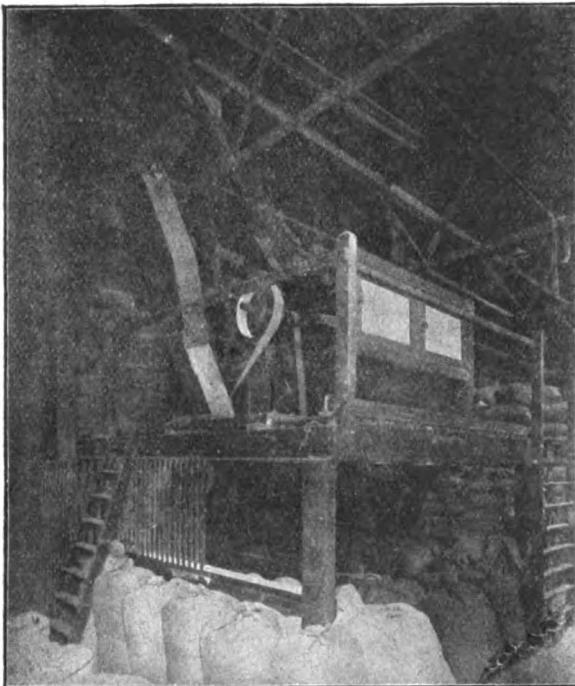


FIG. 3.—20 H.P. MOTOR DRIVING A BRAN DUSTING MACHINE
AND A SACK PACKER.

from which power is delivered to the main "Witton" switchboard of the mill at 400 volts. As the power consumption to about 1,000 h.p. continuously from Monday morning to Saturday noon, this mill is one of the best customers of the Corporation. Electric lighting by Osram lamps is used exclusively, and it may be noted that there is a reduction in fire insurance premiums for flour mills which are lighted electrically. The drive throughout is by two-phase semi-enclosed squirrel-cage Witton motors, and oil-immersed auto-starters are used for all motors over about 5 h.p. Many of the motors had to be put in somewhat inaccessible corners, but the control system in the mill has been centralised, so that many of them are started from the ground floor. In connection with the operation of the starters there is a system of electric bells throughout the mills, so that by pre-arranged signal those in charge of the different floors indicate to the charge man on the ground floor when the motors are to be started or stopped.

Practically all the grain arrives by boat, and the cargoes are discharged by two elevators, driven by 12 h.p. "Witton" motors, and each of a capacity of 40 tons per hour. The grain is weighed as it comes from the elevators, and is carried by band conveyors and bucket elevators to the distributing bands at the top of the silo house, which consists of eight cylindrical chambers of ferro-concrete, having a total capacity of 20,000 quarters of wheat. The grain is transferred as required by other conveyors and elevators to the cleaning house. Here the coarse impurities and light grains are removed by sifting and exhaust fans, and foreign seeds are separated. After a thorough scouring the grain is passed through a washing machine, which also removes the stones. A centrifugal dryer removes practically all the surplus water, after which the clean grain is dried

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in a stream of warm air propelled by exhaust fans. The grain is allowed to cool, and is then scrubbed in a vertical brush machine shown in Fig. 1, of which there are three, each driven by a 10 h.p. vertical motor. The wheat is first broken in Robinson grooved roller mills on the ground floor, group driven from line shafts driven by the motors in the basement, illustrated in Fig. 2. The product of the breaking rollers is elevated to the top floor, where it is sifted into various sized grades by machines fitted with vibrating silk sieves and known as "plansifters." The motors driving the elevators and the exhaust fans, by which the dust is carried away, are at the top of the building. The separated constituents from the plansifters descend by shoots to the next floor, where exhaust fans separate and carry away the lighter particles of bran—that is husk—to which no flour adheres. On the floor below and the ground floor the products are ground to increasing fineness, being carried up to the machinery mentioned above to go through the cycle of sifting and purifying after each reduction, until all the flour is extracted, and the residue is only suitable for animal food.

There are several isolated machines for mixing, sack filling, handling, &c., driven by separate motors. Fig. 3, taken in the bran house, shows, for example, a bran dusting machine driven by a 20 h.p. "Witton" motor, with a small sack packer by its side. The old engine-house has been put to use in housing mill stones used in the production of whole meal and the reduction of "middlings" to make animal food.

We understand that the steady drive following this electrification has resulted in a greater uniformity of the flour, and that, among other advantages and conveniences, weekend work on plant for maintenance has become of rare occurrence. The mill, which has a capacity of 50 sacks of flour per hour, is now one of the best equipped in the country. Acknowledgments are due to Mr. Chapman, the manager of the mills, for permission to publish these details.

SERIOUS FLYWHEEL ACCIDENT AT CARDIFF

A SERIOUS accident, causing damage estimated at £20,000, occurred on Sunday night in the Roath Electricity Works at Cardiff, when a flywheel weighing some seventy tons burst and wrecked the generator to which it was attached. A piece of the rim, weighing half a ton, crashed into the boiler-house and smashed into a boiler which was, fortunately, not under steam at the time. The tramway service was suspended throughout Monday, but largely due to the battery at the Hayes station, the greater part of the lighting load was maintained. Fortunately, there was no loss of life nor injury to persons. From the account given at the special meeting of the Tramways and Electric Lighting Committee on Monday, it appears that the main cause of the continuance of the shut-down of the station is the damage to the circulating water pipes. Mr. A. Ellis (Manager and Engineer to the Electricity Department) stated that the large engine was damaged to an extent that it would not pay to repair, but the engine opposite was not so seriously damaged. The most serious difficulty was the breaking open of the 20-in. circulating pipes, which has flooded the engine-room and affected the foundations. A considerable amount of concrete had also been broken up by the bombardment of pieces of the flywheel. New pipes were being supplied by the waterworks department. Four old engines in the adjoining engine-room had been put to work, and some load was taken meanwhile by the Hayes battery. The cause of the running away of the engine remains unexplained. The engine had just been put on load, and suddenly began to accelerate at such an alarming rate that the driver, who was unable to check it, warned everyone to stand clear. Structural repairs are being proceeded with.

"ELECTRICAL ENGINEERING" TRADE SECTION

THE WORKS OF BRUCE PEEBLES & CO.

A N interesting booklet from Bruce Peebles & Co., describing their works and some of their products, gives a very good idea of the extent of their manufacturing facilities, the admirable arrangement of their works, and the range of electrical plant turned out. Situated at East Pilton, not far from Edinburgh, almost on the banks of the Firth of Forth, and linked up by sidings with the Caledonian Railway, the works, with its offices adjoining, its own water supply, sewage plant, and power equipment is entirely self-contained. The main shop is 600 ft. long by 150 ft. wide, divided into five bays, and provided with side galleries. The centre or main bay, as is usual in such works, is devoted to large machine tools and heavy erecting work, while the lighter tools and operations find accommodation in the side bays and galleries. Light railway lines run right through, and the general arrangement is such that, as far as possible, the work travels in one direction as it progresses, from the entry of raw material at one end to the packing and despatch departments at the other. The power-house contains two steam-driven Peebles D.C. machines, one for 500 kw. and one for 250 kw., and power is distributed about the works on a three-wire system with 500 volts across the outers. A storage battery permits of a certain amount of power being taken, and the lighting being maintained when the generating plant is not running. A gas-producer plant is also provided, for supplying drying ovens, annealing stores, &c. There is also a compressed-air service and a system of fire pumps.

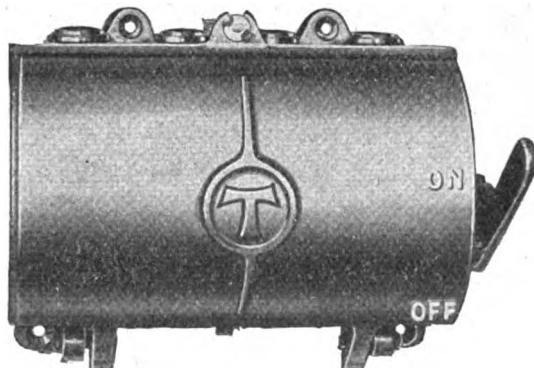
The special departments in the side bays and galleries include a core-plate stamping and notching department, the commutator-building section, the all-important tool-room, a light-machine shop, &c., and the whole of one end of the west bay is occupied by the winding department, adjoining which is the varnishing room, with its drying ovens, vacuum-impregnating tanks, &c. Further departments are another machine bay, a light erecting shop, and a mica-insulation room. In other parts of the works are the pattern shop and foundry, and an interesting feature of the latter is the way in which the end rings of squirrel-cage rotors are cast on from a special alloy. An important part of the establishment is the fully-equipped testing department.

The machinery manufactured comprises A.C. and D.C. motors, dynamos and alternators of every kind, including

turbo-generators, and many interesting features are involved in the company's special designs. The firm is particularly famous as being the manufacturers of the Peebles' motor-converter (Peebles la Cour patents), the special advantages of which are now too well known to need insisting upon here. The booklet to which we have referred is excellently illustrated, with views of the works and numerous representations of typical Bruce Peebles plant, and those interested in such things cannot do better than ask for a copy and see for themselves the high position occupied by this entirely British firm of manufacturers of electrical plant.

A NEW IRONCLAD SWITCH

A DESIGN of ironclad switch intended for conditions where a first-class job is necessary, but price is a vital consideration, has been put on the market by J. H. Tucker & Co. (King's Road, Hay Mills, Birmingham). A usual feature in low-priced ironclad switches has been a slot for the working of the handle in the centre of the cover with

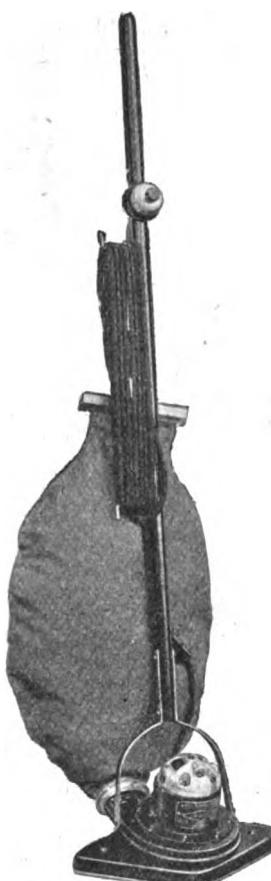


TUCKER D.P. IRONCLAD SWITCH.

attendant difficulty in earthing the handle. This switch, while costing no more than the slotted type, has the handle at one side in the D.P. pattern, and of the stirrup design in the triple pole pattern, so that the handle is in permanent and certain contact with the case for earthing purposes. Each

pole is mounted on a separate vitreous china base, the cover is interlocked with the handle, and the position of the switch is indicated on the cover. A substantial earthing terminal is provided, and the cases are enamelled and stoved to a high-class finish. The wiring facilities and other details have received great care, and these switches, which are at present ready in the 30- and 50-ampere sizes, are remarkably good value for the money.

AN ELECTRIC SUCTION CLEANER

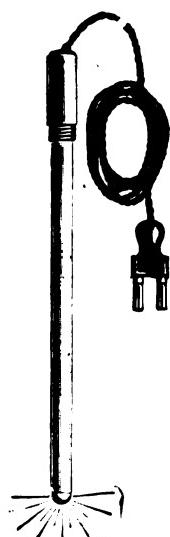


THE BRILLIANT SUCTION CLEANER.

SIMPLEX Conduits, Limited, have just placed on the market the "Brilliant" electric suction cleaner, which is of the self-contained type, as shown in the illustration. In this, special attention has been given to the mechanical and electrical design of the high-speed motor with which the cleaner is fitted, and also to the conformation of the fan blades, which are of cast aluminium. These two parts are largely responsible for the very high efficiency of the apparatus, and for the high degree of suction which it creates. The diamond-shaped shoe is a patented feature of the machine, and this shoe is fitted with castors, which allow the machine to run very easily over carpets and rugs, and at all times to suck in the air regardless of the thickness of the carpet. The shoe is also fitted with a revolving brush, which is capable of picking up threads, &c. This cleaner is fully described in an attractive leaflet which the company have issued, and contractors and electrical dealers can obtain supplies of this leaflet overprinted with their name and address on request. The apparatus retails at five guineas, and is, we believe, the cheapest electrical suction cleaner on the market.

ELECTRO-MEDICAL APPARATUS

THE importance of electro-medical treatment of various kinds is now so firmly established that such a well-arranged price-list as the new ninth edition of that issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) is to be welcomed. The first part is devoted to induction coils complete, with or without the necessary batteries, and a great variety of special electrodes for use with these are listed. Apparatus for electrolysis, or destruction treatment of tissue by small continuous current, and depilation or removal of superfluous hairs, as well as cautery knives, are completely represented. Another useful appliance is the "eye magnet," for withdrawing ferromagnetic particles from the eye. For use in this case and others by ophthalmic surgeons, as well as by dental surgeons and doctors, special kinds of lighting equipment are necessary. Numbers of ingenious designs of these are contained in the list under review. We illustrate here a dental lamp. This is stated to be the smallest manufactured. It is made entirely of glass, and can be sterilised after each operation. Batteries naturally form a feature of the list, and those represented include the Leclanché, Carsak, Edison-Lalande, and bichromate types, as well as portable accumulators. Other apparatus includes delicate measuring instruments, switches and selectors, while at the end of the list are to be found parti-



GLASS DENTAL LAMP.

includes delicate measuring instruments, switches and

selectors of the "Kingsway" massage vibrator, the "Kingsway" hair dryer, Ozone apparatus, battery fans, battery lighting sets and accessories, various novelties, and a full range of electric tattooing apparatus, of English make.

THE MARVEL SWITCH

A S many of our readers who have studied the fascinating subject of modern electric light switching will know this is the name given by A. P. Lundberg & Sons (477 to 489 Liverpool Road, N.) to a special switch that they have developed to effect a variety of modifications of lamp control. The switch resembles externally the ordinary tumbler switch, but has five or sometimes six terminals and fixed contacts, while a number of moving contact studs are mounted on an insulating piece of half-moon shape, to the top of which the metal switch rocker is fixed. The chief feature of the switch is that it has three positions, up, down, and straight out, although there is only one control spring. The connections between the moving contact studs can be easily varied, so that switches of this class can be arranged for a vast variety of different uses, and when two slightly differently arranged are employed together, one acting as an intermediate switch, a vast number of possibilities of control are opened up. The switch, in the various forms in which it is made and its manifold uses, are described in a new leaflet from the manufacturers, which is a revelation of the state of perfection the art of switching has been brought.

DISPUTE re OWNERSHIP OF CARBONS

A SEQUEL to police court proceedings last August, when some men were accused of stealing £2,000 worth of carbons from the works of the Foster Engineering Co., was heard at the Law Courts on Wednesday before Mr. Justice Eve. It appears that the carbons in question were really the property of the German firm of Conradty, whose agents are, or were, the Sloan Electrical Co. Under an agreement between Conradty and the Beck Engineering Co., made in May, 1912, the Conradty Co. was to supply carbons as required to the Beck Co. at market prices, and to keep a sufficient stock in London. At first this stock was kept at the Beck Co.'s works at Hayes, but on the Foster Co. taking over the manufacture of the Beck lamp, the stock was transferred to the latter Co.'s works in Wimbledon. It appears, however, that the licence to manufacture the Beck lamp was subsequently retransferred to the Beck Co., but the Foster Co. refused to agree to transfer the stock of carbons to them, as, by the agreement, the consent of Conradty was necessary. As this was not obtainable last August, the Beck Co. took the law—or their version of it, at any rate—into their own hands, and removed the carbons from the Foster works forcibly in the early hours of a Sunday morning. An order was subsequently made for the carbons to be restored to the Foster Co., pending the hearing of the case. This case was now to decide whether the Beck Co. had a right to the carbons at the prices current before the war. The judge decided that this was not so, and that the carbons, if required, must be invoiced to them at present ruling prices by the Sloan Electrical Co. A counter-claim for damage done to the carbons by the forcible removal was not successful.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aberdare.—Motor-generators or converters; H.T. switchboard, L.T. panels, and H.T. feeder pillar. Borough Electrical Engineer. April 6th.

Australia.—The Victorian Railway Commissioners require electric lighting material for the car repair shops at Jolimont, including cables, switches, lampholders, &c. Railway Offices, Spencer Street, Melbourne. Further particulars at 73 Basinghall Street, E.C. April 28th.

Bedford.—Owing to the failure of one of the turbines last week, certain of the cables have been so severely strained as to necessitate renewal. An expenditure of £700 is contemplated in this connection.

Blackrock.—The Council has applied for a loan in connection with its electric lighting scheme, but the L.G.B. require to be furnished with the Engineer's specifications before proceeding further.

Bridgend.—A 400 kw. generating set. Borough Electrical Engineer. April 8th.

Brighton.—Surface condenser for Southwick power station. Chief Electrical Engineer, April 12th. (See an advertisement on another page.)

Edinburgh.—Water-tube boilers are required by the Corporation. City Electrical Engineer. April 12th.

Grays.—A L.G.B. inquiry was held last week concerning a loan of £600 for electrical purposes.

Hull.—In consequence of the Treasury restrictions upon capital expenditure and a suggestion made by the L.G.B., the scheme for extensions is to be cut down to a 5,000 kw. turbo-alternator and a boiler, reducing the capital expenditure from £41,500 to £26,445. The loan is not to exceed £20,000, any balance to be met out of the reserve fund.

Wiring

Cowdenbeath.—New school in Barclay Street. Borough Surveyor. March 31st.

Edinburgh.—New Western District Sorting Office. H.M. Office of Works, Storey's Gate, London, S.W.

Glasgow.—Electric lighting of Shakespeare School, Maryhill. Clerk, 129 Bath Street.

London: L.C.C.—265 lighting points at Derington Road School, Lower Tooting. Clerk to Council. March 31st.

Islington.—The Guardians have appointed Mr. W. C. C. Hawayne as their Consulting Engineer, but the scheme is not to be proceeded with for six months.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Accrington.—Cinematograph theatre. R. Stewart, Manchester Road.

Barnstaple.—Technical Institute (£10,000).

Salisbury.—Memorial Hall. Architects, John Harding & Son, 58 High Street.

Torquay.—Technical Institute (£10,000).

Walsall.—Considerable additions to Union premises. Clerk.

Miscellaneous

Australia.—The Victorian Railway Commissioners require two electrically-driven trucks capable of dealing with a load of 4,000 lbs. each. Railway Offices, Spencer Street, Melbourne. Further particulars at 73 Basinghall Street, E.C. April 28th.

Bray.—Twelve months' supply of electrical stores. Borough Electrical Engineer. April 6th.

Greece.—A central exchange and telephone system is required at Salonica; a central exchange at Athens; and a general supply of telephone apparatus and accessories. Further particulars at 73 Basinghall Street, E.C.

Harrogate.—Twelve months' supply of electrical fittings and sundries for Wells and Baths Department. General Manager. March 29th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Aberdare.—A contract for a twelve months' supply of Wotan, half-watt, and carbon filament lamps has been placed with Siemens Bros. Dynamo Works, Ltd.

Coventry.—An order has been placed with Messrs. E. Dennis & Co. for eight chain grate stokers for B. & W. boilers.

Manchester.—An order has been placed with Messrs. E. Dennis & Co. for the re-linking of two pairs of chain grates of another make, with the "Dennis" patent chain grate link, at the Bloom Street power house.

London: L.C.C.—An order for a twelve months' supply of carbon filament lamps has been placed with Siemens Bros. Dynamo Works, Ltd.

The Highways Committee reports that all the tenders for two 8,000 kw. turbo-generators for Greenwich were submitted subject to the Institution of Electrical Engineers' model conditions of contract. These, however, differ in many respects from the Council's standard conditions, and, as a consequence, arrangements have been made with the British Westinghouse Co., the successful tenderer (£62,003), with a view to certain modifications of the Institution contract conditions, in order to bring them as far as possible into line with the

Council's standard conditions. These chiefly relate to the payments.

Bermondsey.—The tender of Venner & Co. for a twelve months' supply of Chamberlain & Hookham meters and time switches has been accepted.

APPOINTMENTS AND PERSONAL NOTES

Lieut. Harry Byng, third son of the late Mr. Gustav Byng (founder and late chairman of the General Electric Co., Ltd.), was married very quietly on Monday at St. Mary's, Bryanston Square, to Miss Evelyn Curtis, of Boston, U.S.A. Lieut. Byng, who is in the Border Regiment, had only just returned from the Front on five days' leave, and is now on his way to the Front again.

The supplement to the *London Gazette* for March 17th announces that Second Lieut. H. Clifford Palmer has been appointed Captain (temporary) in the London Scottish. The appointment dates from March 4th. We are very glad to hear that the well-known manager of the Publication Department of the General Electric Co., Ltd., has recovered from the effects of his recent operation, and is able once again to take a part in the defence of his country.

The salary of Mr. F. C. Pedley, Borough Electrical Engineer at Bingley, is to be increased by £30 per annum, and that of the Assistant Electrical Engineer by £26 per annum.

A meter tester is required at Barrow-in-Furness (45s.); switchboard attendant at Blackburn (40s.); and two shift engineers at Brighton (30s.). (See advertisements on another page.)

An assistant is required in the Sheffield Electricity Department. £88 per annum. General Manager.

Switchboard attendants are required at Stretford, Wakefield, Burnley, and Portsmouth. Borough Electrical Engineer in each case.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £74 10s. to £75 (last week, £71 5s. to £71 15s.).

Change of Address.—E. Brook, Ltd., late of 178 Gray's Inn Road, W.C., have removed their London office to 11 Queen Victoria Street, E.C. (Tel. City 4468).

Liquidations.—A meeting of the Wolf Safety Lamp Co. will be held at the offices of John Gordon & Co., 19 Bond Street, Leeds, on April 19th, at 3 p.m., to hear the liquidator's account of the winding-up.

Miniature Rifle Ranges.—The British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), have sent us a photograph of their miniature rifle range which is being used for the training of some of the Manchester Battalions. The Company have long had a small range at the Westinghouse Club, and this larger range was built at the outbreak of war. No less than thirty-six men can shoot at one time on this range, ten at 25 yards, and twenty-six at 50 yards. The cost of the range, together with the rifles, telescopes, &c., was largely covered by voluntary subscription of the employees, and a considerable part was built by them. The Westinghouse Company gave considerable financial assistance and lent the grounds.

The Electrical Equipment of Docks.—A compulsory winding-up order has been made against Messrs. Tannett-Walker & Co., hydraulic and general engineers, of Hunslet, Leeds. The Official Receiver, in his report upon the affairs of the Company, attributes the failure as being partly due to the change from hydraulic to electric machinery in the equipment of docks and railways.

German Turbine Orders Cancelled.—*The Times* states that the Lambton & Hetton Collieries, Ltd., has cancelled a contract placed with the A.E.G. of Berlin some time ago for three large turbo-alternators for their Philadelphia power station. The order has now been divided between J. Howden & Co. (Glasgow), W. H. Allen, Son & Co. (Bedford), and Siemens Bros. Dynamo Works, Ltd. (London).

LOCAL NOTES

Aylesbury: *Hired Motors.*—The Council has agreed to adopt a scheme put forward by the British Thomson-Houston Co. for hiring out motors. Accommodation will be found at the electricity works for exhibiting the motors.

Burton: *Rate in Aid.*—The Electricity Committee recommends the sum of £4,000 being transferred to relief of rates for the year to March 31st, instead of £8,000 as in the previous twelve months. The reason for this is the prospective increased price of coal and the fact that at the moment the undertaking has practically no reserve fund.

Bury: *A Correction.*—We regret that the note published in this column last week with regard to the refusal to sanction a loan at Bury was incorrect. There has been no L.G.B. inquiry at Bury for nearly twelve months. Although it had been proposed to proceed with certain extensions of the Chamber Hall Power Station, at an expenditure of £25,000, the greater part of which work had already been sanctioned by the L.G.B., it has now been decided not to proceed with the work at present in view of the general request of the L.G.B. with regard to the limitation of expenditure on extensions.

Coventry: *Loan Sanctioned.*—The Treasury has given consent to certain extensions of the electricity plant in order to meet the demand from factories employed upon Government work. The loan (£46,932) has been sanctioned without the usual formality of an inquiry, and the work is now in hand.

Dublin: *The Increased Lighting Charges.*—Once more the Electricity Committee has to report a change in its plans with regard to the increased charge for electrical energy. As reported in our columns, it was at first announced that an increase of $\frac{1}{2}$ d. per unit for lighting supply and $\frac{1}{2}$ d. per unit for power would be necessary, but subsequent consideration rendered it necessary to increase this to 1d. in the case of lighting and $\frac{1}{2}$ d. in the case of power. Now, however, it is indicated that the estimates upon which the increased working costs were based were not absolutely accurate, and that as a result only "a small increase" in price to consumers need be apprehended.

Kingston: *Increased Charges.*—The Electricity Committee having, mainly through the reduction in the street lighting, to face a deficit of some £1,300 in the coming year, has decided that the consumers, and not the rates, must bear the loss, and an increase in the lighting rate of from 5d. to 6d. per unit was recommended. When the matter came up for discussion in the Council, however, an amendment, authorising an increase of 10 per cent. upon all consumers except those protected by special contracts, was passed.

London: *St. Pancras: New Loan.*—A loan of £8,970 is to be taken up from the L.C.C. at 4 $\frac{1}{2}$ per cent. as follows:—mains, £2,587; plant, £1,140; services, £2,676; meters, £1,835; arc lamps for outside lighting, £732.

Manchester: *Fatal Electric Shock.*—An apprentice at the Westinghouse Works unfortunately received a fatal electric shock whilst testing motors last week. Mr. Topham, H.M. Inspector of Factories, at the inquest said that the work in question involved more or less temporary connections, and it was for that reason that testing departments were exempt from certain Home Office regulations, provided proper precautions were taken. In his opinion, the necessary precautions had been taken, and the accident was unavoidable.

Pembroke (Ireland): *Increases in Charges.*—In view of the increase in capital and other charges, and the possibility of still further rises in the price of fuel, the Electricity Committee recommend increases in the charge of electricity of one penny per unit for private lighting, 4d. for heating and cooking. Increases are also recommended for power supply.

Tunbridge Wells: *Loan Refused.*—After a protracted inquiry concerning a loan of £7,520 for electrical extensions, Mr. H. R. Hooper, the L.G.B. Inspector, indicated that it is very improbable that the loan will be sanctioned, presumably owing to the absence of exceptional circumstances.

COMPANIES' DIVIDENDS, REPORTS,
MEETINGS, &c.

Metropolitan Electric Supply Co.—The progress of this Company was quite satisfactory during the first half of 1914, said the Chairman at the annual meeting last week, but the war soon placed the Company in difficulties both as regards coal supply and the loss of some of their most experienced workmen. Then the unforeseen loss of revenue from street lighting had to be faced during the usually most profitable months of the year, hence the reduction in dividend. With regard to the London power scheme, he looked forward to friendly co-operation between the Companies and the County Council, and the evolution of a satisfactory scheme.

City of London Electric Lighting Co.—The reduction of 1 per cent. in the dividend for 1914, compared with 1913, was attributed to similar reasons to those given by the Chairman of the Metropolitan Company at the annual meeting. The right of the City Corporation to purchase the City portion of the Company's undertaking expired on February 18th, and the Chairman thought the shareholders might now take it that the undertaking was secured to the Company for the rest of the term of the Provisional Order.

Brompton & Kensington Electric Supply Co.—Attention was drawn at the annual meeting on Thursday to the fact that although the Company's undertaking earned £1,200 less in 1914 than in 1913, and £1,700 less in 1913 than in 1912, the Assessment Committee has increased the assessable value by £1,450. An appeal is to be made. The accessories business continues to make satisfactory progress, and designs have now been completed for a great variety of apparatus. Equipments are being installed in several of the most important cities in the country, and a profitable development of this branch of the business is anticipated. In common with the other companies concerned in the Electric Power Bill, it is intended to persevere so as to arrive at an amicable settlement.

Newcastle-on-Tyne Electric Supply Co.—The Treasury has approved the issue of £167,000 4 $\frac{1}{2}$ per cent. consolidated first mortgage debenture stock.

British Electric Transformer Co.—At the annual meeting last week, the Chairman, Mr. A. F. Berry, explained the reasons for the reduction in dividend of from 10 per cent. to 7 $\frac{1}{2}$ per cent. The dislocation of transport was, he said, a material factor, whilst 80 per cent. of their workmen within the age limit had joined the Colours. Again, three of the largest contracts in hand for railway companies were held up, and practically the only work now being done is for the Government. Latterly, however, things had become more normal, and the shareholders might reasonably look forward to an improved result next year.

W. T. Henley's Telegraph Works Co.—Mr. George Sutton, the Managing Director, emphasised at the annual meeting last week that whatever might be the case elsewhere, the Company was not making large profits out of the supply of war materials. However, should they execute the orders now on their books and not take another order during the year, they would be able to pay the usual dividend in 1915.

W. T. Glover & Co.—Although the dividend recommended for last year is only 5 per cent., it was explained at the annual meeting last week that the amount in hand would have justified the directors in recommending 12 per cent. The fact, however, that the Company's business is largely with corporations and municipalities, upon whom it is not yet possible to measure the full effect of the recent Treasury regulations, has caused the directors to be exceedingly careful.

Sterling Telephone & Electric Co.—According to the *Financial News*, a mortgage of £10,000 has been carried through, the mortgagee being Lord Kitchener. Presumably this is in connection with work for the War Office, as the Company has made a special feature of apparatus for electrically firing mines, field telephones, &c.

British Westinghouse Co.—The report for 1914 shows a net profit of £151,627, to which is added £6,493 brought forward. General reserve is credited with £50,000; patents, goodwill, &c., are written off to the extent of £25,000; and after paying 7 $\frac{1}{2}$ per cent. on the preference shares, there is a balance of £8,121 to be carried forward. The net profit is considerably in excess of that in 1913, and substantial sums have again been charged against revenue for the maintenance of the works and plant, in addition to £50,846 for depreciation.

Brush Electrical Engineering Co.—The report for 1914 states that although the war caused a temporary diminution in business, orders received since the beginning of this year are above the average. The profits allow of placing £10,000 to depreciation, and debenture interest absorbs £19,109, leaving £7,065 to be carried forward. The experience with the Liungstrom steam turbine has been sufficiently satisfactory to justify further capital expenditure for its production on a larger scale. Subject to Treasury consent, it is proposed to issue the balance of the participating second debenture stock.



ELECTRICAL ENGINEERING

With which is Incorporated
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(Established 1884)

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SUMMARY

WE publish some further letters from central station engineers regarding the restriction of electricity works extensions (p. 138).

MR. C. B. SPARKS has been nominated as President of the Institution of Electrical Engineers for next session. We also publish a list of the other nominations to the Council for ballot next month (p. 139).

THE wiremen in the L.C.C. Tramways Department who came out on strike have decided to accept a decision by Sir George Askwith that the agreement under which they are working does not entitle them to any higher rate of wages during the two years' currency of the agreement (p. 139).

THE Development Committee of the I.M.E.A. is continuing its work, and hopes shortly to establish a scheme of publicity literature (p. 139).

MR. C. JOHNSON in a recent Paper described a year's experience with electric miner's lamps (p. 140).

EXPERIENCES with several types of colliery trailing cables were described by Mr. J. Bentham in a Paper before the Association of Mining Electrical Engineers (p. 140).

THE effect of leakage currents on oil in bearings was referred to at a meeting of the Association of Mining Electrical Engineers lately (p. 140).

ILLUSTRATED articles describe examples of mining switchgear and electrical plant (p. 141).

THE London electric supply companies have decided to increase their charges for lighting and power on account of the higher freightage on coal (p. 142).

PRACTICAL points in connection with D.C. motors were contained in a Paper by Mr. E. F. Butler read recently before the Association of Supervising Electricians (p. 142).

THE recovery of copper from the liquid in pickling vats is dealt with in our Questions and Answers column (p. 143).

AMONG the subjects of specifications published by the Patent Office last Thursday were a self-regulating booster transformer, a method of manufacturing condensers, special tubular lamps for street lighting, and a method of inductively loading duplex telephone lines. Patents relating to trolley-wire suspension and lead-covering of cables expire this week after a full life of fourteen years (p. 144).

CONSIDERABLE extensions to the electric supply system have been carried out at Ipswich (p. 145).

THE Treasury will not approve of the proposed expenditure of £271,900 on tramway extensions in London (p. 145).

MARCONI'S Wireless Telegraph Co. is unable to declare an interim dividend on the ordinary shares owing to outstanding questions of compensation from the Government.—The Automatic Telephone Co. reports satisfactory progress with its exchanges in various parts of the world.—Judgment for £2,640 has been given against the Marconi Co. in an action for breach of contract (p. 145).

The Treasury has sanctioned a loan at Haslingden (£12,000); the Llandudno Council having been refused a loan of £2,000 has decided to provide the money out of revenue; extensions are contemplated at Sheffield (£85,400); cable is required at Basingstoke and Hampstead; meters at Battersea; lamps for the Bristol Docks; tramcar trucks, motors, &c., at Bradford; and stores in various places (p. 146).

CONSIDERABLE development is taking place with the Ontario hydro-electric power scheme.—A Rateau turbo-generator has been put into operation at Bexley.—The Poplar Borough Council is reducing its lighting charge by 1d. per unit.—A scheme for generating electricity on a large scale in Ireland by water power is in contemplation (p. 147).

A DIVIDEND of 6 per cent. and a bonus of 12s. per share is declared on the North Metropolitan Electric Power Co.'s ordinary stock.—The British Aluminium Co. had a satisfactory year in 1914 (p. 147).

Obituary.—We regret to record the death on Tuesday of Sir John Cameron Lamb, formerly Second Secretary of the Post Office, from which position he resigned in 1905 after more than forty years' service. Sir John Lamb took a leading part in the general policy as to the relations between the Post Office and the National Telephone Co., and the acquisition of the trunk telegraph lines by the Post Office was carried out largely under his supervision. He was knighted on his retirement.

THE RESTRICTIONS ON ELECTRICITY WORKS EXTENSIONS

WITH reference to our articles on this subject (*ELECTRICAL ENGINEERING*, March 11th and 25th), we now publish extracts from further letters which we have received from central station engineers:-

Cardiff.—Mr. Arthur Ellis writes: I have no doubt that those authorities who are fortunate enough to have reserve funds in hand will be able to meet the requirements for the time being, and I have no doubt also that the L.G.B. afterwards will appreciate the position of those authorities from a financial point of view when they seek further borrowing powers. As regards Cardiff, perhaps we are in the happy position of having only recently completed considerable extensions to plant, &c., and having obtained loans from the L.G.B. for other purposes that will see us through for some period of time, and possibly the reserve fund that we have in hand will assist us out of any difficulty. As regards devoting profits to the relief of rates, I am pleased to say that my Committee so far are devoting their profits to a reserve fund until they are satisfied that they have a reserve fund of sufficient amount to meet the requirements of the undertaking, and provide for obsolescence of plant, depreciation, &c. I do not see that any advantage would be gained by suspending the contributions to the sinking fund, as it would be a very costly matter to do so, additional interest having to be paid during the period that such payments are suspended. As regards the concluding paragraph of your article upon the subject, I can hardly imagine that the electric supply authorities would be held liable to an action for not fulfilling their statutory obligations under the Electric Lighting Acts, &c., as, of course, in a sense the operation of such Acts are suspended as a result of the action of the L.G.B. and the Treasury.

Carlisle.—Mr. F. W. Purse writes: I do not agree with your suggestions to meet necessary expenditure out of revenue or reserve funds. Posterity should have a little to pay for, and it is hard enough now to struggle along with short loan periods, high rates of interest, and taxation without having to deplete reserves. The situation to my mind is quite clear; those works that are finding it necessary to extend must only be in such a position owing to heavy demands due to the production of war material, and for such the Government should give facilities for loans, and failing that the local authority can refuse to supply the extra demand. I think the L.G.B. will not object to sanctioning extensions and new schemes, but will delay the power of borrowing the money until the conclusion of the war. Most of the available works are turning out war munitions at a terrific rate, and at the conclusion of the war there is bound to be a big slump in this; if, therefore, a lot of other work is waiting to be proceeded with without delay, it will fill in the interval between the cessation of Government orders and the restoration of the normal trade dislocated by the war which cannot suddenly assume its natural dimensions. On the whole, therefore, I think the action of the L.G.B. is sound.

Croydon.—Mr. A. C. Cramb writes: Certainly those undertakings that have been able to build up their reserve will be in a happy position in regard to financing, at any rate, some of their extension work. With reference to allocation of profits to relief of rates, I do not think that is likely to worry us, at least for some time to come, considering that our coal is costing us about £240 per week above what it should do.

Eastbourne.—Mr. J. K. Brydges writes: We are not affected by the refusal of the L.G.B. to grant loans for extensions, as we received sanction for a loan for £4,000 for new feeder cables and extensions early last year. Our capital expenditure since has all been taken out of our reserve fund, which fortunately, with renewals fund, stands at about £21,000. This will, however, be rather heavily drawn upon within the next few years, as we bought a 1,500-kw. turbo-alternator the year before last which cost £5,427; we have a new switchboard on order, £1,150; a 1,250-kw. "Ljungstrom" turbo-alternator, £6,000; cables, transformers, substations, &c., not included in the cable loan, £1,400. This makes a total of £13,977. We shall also be requiring a new boiler and an extension of our cooling-water pond within the next two years, which will probably run into another £3,000, so that there will not be very much left in our reserve fund. It is certain, however, that our net profit for the current year will, as in the past, be allocated to our reserve fund. Fortunately there have been only two allocations out of the profits to the relief of the rates of £750, or £1,500 in all, eight or nine years ago. The net profit has always been divided between the reserve and renewals fund and reduction of charges. All our meters are purchased out of the revenue, amounting to £300 or £400 per year.

Glasgow.—Mr. W. W. Lackie writes: The present situation with regard to the refusal of the Local Government Board to sanction borrowing powers for further extensions does not affect Scotland, as we get our loans through the Secretary for Scotland, and luckily, so far as we in Glasgow are concerned, a loan of £500,000 was sanctioned in November, 1912. This will go a long way towards covering the work we at present have in hand. I am afraid you are under a misapprehension with

regard to the use of the reserve fund. This fund simply exists on paper. It is already used in the business, and so saves payment of interest, &c., out of revenue for capital which would otherwise require to be borrowed. At a time like the present, however, we in Scotland experience the value of refusing to allocate surplus revenue from Corporation trading departments to the relief of local rates.

Halifax.—Mr. W. M. Rogerson writes: For some little time past we have been extending our plant out of revenue, and have spent some £15,000 in this way. With regard to the allocation of profits to the relief of rates at Halifax, each trading undertaking must contribute an amount equal to $\frac{1}{2}$ per cent. upon the gross capital yearly. Any profit made over the above $\frac{1}{2}$ per cent. can be used by each undertaking as it thinks fit.

Leeds.—Mr. C. N. Hefford writes: Up to the present I have no reason to suppose that the policy of the Government will be applied in such a way as to interfere seriously with the Leeds electricity undertaking. We have important extensions in progress which have been generally approved by the Local Government Board, and, so far as I can judge at present, no interference with really necessary extensions will take place in the case of undertakings serving industrial areas. Perhaps a more-likely cause of difficulty will be the appropriation of engineering works for war purposes, leading to delay in the delivery of generating plant, but I cannot think that even in this direction the Government will take steps which would diminish the usefulness of electric supply undertakings, and thereby limit the output of war materials, in the manufacture of which electrical energy is used. The Leeds Corporation have issued instructions for the restriction of capital expenditure to the smallest practicable figures, and in pursuance of this policy the Electricity Department will largely reduce its activities in the matter of mains extensions, upon which item something like £80,000 has been spent during the past year, but it is not intended to place any difficulties in the way of intending consumers who require supplies for industrial purposes. With regard to the question of spending money out of reserve funds, it appears to me that this would be little better than an evasion of the Government's orders, as, whatever the source of the money, any capital expenditure needlessly incurred at present represents an encroachment upon the funds available and reduces the facilities for obtaining money for national purposes. The same remark, I think, applies to the suggestion for the suspension of the contributions to the sinking fund.

Tunbridge Wells.—The recent L.G.B. inquiry, with its probable result, was referred to briefly in our last issue (p. 136), but the following particulars are of interest. The loans for which sanction was required were for extensions in the boiler-house, and a cooling tower. Mr. Ross Hooper stated that he would not recommend the Board to grant the loans, and that the Electricity Department must cease connecting any more consumers. Undertakings that had no spare plant, he said, were to continue to run without spare—they must take the risk, and the consumers must, if necessary, be put to inconvenience until the war is over. The refusal of the loan for the cooling tower, Mr. R. N. Torpy tells us, places him in a very awkward position. The existing and only cooling tower is in such a decayed state as to be nearly falling down; in fact, it has been partly blown down on two occasions; besides this, it is not much more than half the capacity required for ordinary working conditions. He was informed that they must run non-condensing during the summer, and pull the old tower down and rebuild it out of revenue. It was pointed out to Mr. Hooper that a further loan for mains would probably be asked for, as it was necessary to duplicate a number of high-tension trunk mains owing to the fact that they last winter were working on a 25 per cent. overload; but he replied that in all probability the Board would not entertain the loan, and that the mains must continue on this overload. On the other hand, the various Government departments are not entirely consistent, as four very large gangs of men have just been laying miles of telephone cables and conduit for private subscribers all over the town. Mr. Torpy raises another interesting point. He says: We have a large reserve fund, and anticipate a large net profit this year just completing; it would therefore be anticipated that some of the new expenditure could be made from this source; however, the legal side of the question comes to the fore, and we are advised that this cannot be done legally, although I understand undertakings are doing it throughout the country. I am certainly of the opinion that it would be of great advantage if the Board would express their opinion on this point, and that, owing to the exceptional circumstances, undertakings should be allowed to use their surplus and reserve fund to defray necessary capital expenditure. In conclusion, I must say that if it is necessary to curtail all further advancement of undertakings which are now applying for further loans, it is surely necessary to curtail expenditure of undertakings which already have large loans granted and unexpended.

A number of other letters have been received, which will be published in our next issues, and further correspondence is invited.

THE INSTITUTION COUNCIL

THE nominations by the Council of the Institution of Electrical Engineers for the new Council for 1915-16 will be received by members this morning.

It had been the unanimous desire of the Council to nominate Sir John Snell for a second year of office as President, but he regretted that for reasons of health and on account also of the claims of his professional work he felt unable to accept a second year of office.

Mr. C. P. Sparks has therefore been nominated as President, and we are sure that this will be received with universal favour. Mr. Sparks has served several terms on the Council, was Vice-President from 1906 to 1909, and was Senior Vice-President in 1907-8 during the term of office of Lord Kelvin as President, so that he has frequently presided at the meetings of the Institution. He is Engineer-in-Chief to the County of London Electric Supply Co., and has an important consulting practice especially in connection with the use of electricity in mines.

Dr. Alexander Russell (Principal, Faraday House) and Mr. Roger T. Smith (Electrical Engineer to the Great Western Railway) are nominated as Vice-Presidents in succession to Messrs. W. Judd and C. H. Merz, whose period of office has terminated; the two Vice-Presidents who remain in office are Mr. J. S. Highfield and Mr. C. H. Wordingham. Mr. Robert Hammond is nominated for re-election as Honorary Treasurer.

There are five vacancies for ordinary Members of Council, and eight nominations have been made for the ballot next month:—Mr. W. A. Chamen (Engineer and Manager of the South Wales Electric Power Distribution Co.), Mr. H. Dickinson (City Electrical Engineer, Liverpool), Mr. H. W. Firth (Electrical Engineer to the Great Eastern Railway, who read a Paper last session on the "Electrification of Railways as affected by Traffic Considerations"), Prof. T. Mather, F.R.S. (Professor of Electrical Engineering, City and Guilds Engineering College), Mr. H. Faraday Proctor (City Electrical Engineer, Bristol), Mr. G. S. Ram (H.M. Electrical Inspector of Factories), Mr. W. Slingo (Engineer-in-Chief to the Post Office), and Mr. A. H. Walton (Manager, Rugby Traction Dept., British Thomson-Houston Co.).

The five vacancies are caused by the retirement in the ordinary course of Messrs. F. Gill, W. Rutherford, A. H. Seabrook, and by the nominations of Dr. Russell and Mr. R. T. Smith as Vice-Presidents. The ordinary Members of Council who remain in office are Messrs. R. A. Chattock, J. Christie, Prof. B. Hopkinson, F.R.S., G. W. Partridge, W. H. Patchell, R. J. Wallis-Jones, and W. B. Woodhouse.

The three Associate Members of Council all remain in office, and are Mr. F. E. Berry, Major E. O. Henrici, R.E., and Mr. A. W. Martin. Mr. E. Russell Clarke and Mr. A. M. Ogilvie, C.B., remain in office as Associates on the Council, but Mr. H. C. Lewis retires, and Mr. J. Hunter Gray (a well-known barrister in patent actions) is nominated in his place.

It is open to any ten members to nominate other candidates for election before the 21st of this month.

STRIKE OF L.C.C. WIREMEN

AS announced on page 126 of our last issue, the wiremen employed in the rolling-stock section of the L.C.C. Tramways Department have been on strike for an increase in wages of from 10d. to 10½d. per hour, the latter being the recognised rate for men employed as wiremen in buildings by electrical contractors in London. The history of this is given in a report by the Highways Committee to the London County Council this week. The rolling-stock wiremen are at present working under an agreement dated April 3rd, 1914, the period of the agreement being two years, and the rate being 10d. per hour. Since then, as is known, the rate for ordinary wiremen in London has been agreed upon as 10½d., and it is claimed that the agreement of April 3rd, 1914, affecting the L.C.C. rolling-stock wiremen, entitles them to any higher rate which might be agreed upon generally during the period of the agreement. This point was submitted to Sir George Askwith, Chief Industrial Com-

missioner, who decided against the men. The latter, however, refused to accept this decision, and 46 of the rolling-stock wiremen out of 49 struck, whilst 12 of the 24 armature winders employed in the Tramways Department also came out. The Committee remind the Council of the necessity for agreements between the Council and its employees being regarded as binding, but since we went to press last week, the strike has been ended by the receipt of a statement from the three representatives of the men on the Tramways Conciliation Board (Rolling Stock Section) that they have decided to accept the decision of Sir George Askwith.

THE DEVELOPMENT COMMITTEE OF THE I.M.E.A.

AT the last meeting of this Committee the reports of the sub-committees referred to some difficulty in progressing with the operations owing to the present conditions. The question of the production of printed publicity matter was discussed. It is anticipated that a scheme for carrying on publicity work by means of printed matter, Press advertisements, &c., will shortly be brought before the full Committee, and the Committee will endeavour to elaborate arrangements which may, it is hoped, be put in hand in the near future, or at least as soon as general conditions are such as to induce municipal undertakings generally to support the same. Capt. H. C. Palmer (of the General Electric Company) and Mr. L. G. Tate were co-opted members of the Publicity Sub-Committee.

Further discussion arose around the work of the Sub-Committees on "Domestic Appliances" and "Electrical Installations" (Hon. Secs., Messrs. Roles and Allen), and proposals from these gentlemen were considered. It was understood that those and other similar Sub-Committees would probably be able to carry on a very considerable amount of valuable work of a definite character, and in the direction of collating and analysing the mass of information at present existing amongst engineers and manufacturers on the subjects dealt with by the Committees, and that the results of such investigations would be available to the full Committee and also would form useful matter for the guidance of the operations of the Publicity Committee. A further question of making such information generally available for manufacturers and the electricity using public received consideration, and will be referred to again later. The next meeting of the Development Committee will be held on Friday, April 16th, at the Institution of Electrical Engineers.

An Electrically-worked Rolling Lift Bridge.—In the course of an interesting article in the *Engineer* reference is made to the new rolling lift bridge across the Blue Nile at Khartoum, which, as it has a length between abutments of 1,833 ft. 9 in., ranks as the longest and most important bridge in tropical Africa. In addition to two approach spans there are seven more spans, each of 218 ft. 6 in., and a rolling lift span giving a clear opening of 100 ft. The bridge has a clear width between trusses of 36 ft., divided into a 15-ft. clearway for railway track on the east side and a 21-ft. clearway for road and tramway on the west side, and there is also a cantilever footpath, carried outside the west trusses, of 11 ft. clear. Provision has been made to carry an additional cantilever footpath on the east side and a double line of track between the trusses. The rolling span is electrically worked by two 50-h.p. 220-volt continuous-current motors supplied with current from a rotary converter situated in the signal cabin. The motors are geared to a simple rack mechanism, and the controller is interlocked with the locking bolts and signals. The lighting of the bridge is effected by thirty-six 70-volt Osram drawn-wire lamps. These are run two in series off the three-phase mains. Current is taken from the Khartoum Town supply and is delivered at the signal cabin at 3,000 volts three-phase, where it is transformed down to 140 volts. Electricity was used as far as possible for all power and lighting during the construction of the bridge.

University College, London.—The Annual Report reports a considerable decline in the total number of students owing to the large numbers taking an active part in the war, although there has been a slight increase in the number of part-time students. The Faculty of Engineering has been most affected, nearly all the second- and third-year men having either taken commissions or enlisted. The College has organised public lectures in connection with the war, and a large number of Belgian refugee students have been received at nominal fees. Some important changes and additions have been made in the staff of the Faculty of Engineering during the past year. Professor E. G. Coker has succeeded Professor J. D. Cormack in the Chair of Civil and Mechanical Engineering, and Mr. E. R. Matthews, the new Chadwick Professor of Municipal Engineering, has taken up the duties of his Chair.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

ELECTRIC MINER'S LAMPS

A meeting of the North Staffordshire Branch of the National Association of Colliery Managers recently, Mr. C. Johnson described experiences extending over one year with electric miner's lamps of the "Ceag" type, in a colliery where about 125 of these lamps were in use. The initial cost of the installation, including charging stand, &c., worked out at about £1 per lamp, and one year's actual maintenance cost was 6d. per lamp per week. Comparisons were made between districts using oil and electric lamps, and, largely owing to the better light and freedom from going out while at work, the advantage went to the electrically-lit district, where the wage-earning power of the workman was increased. He was of opinion that the greater illumination had reduced the cases of nystagmus. With regard to accidents, although he could not trace a definite diminution in number, the injuries had been less serious, and over 72 per cent. of the accidents had occurred to persons using oil lamps. He had taken a large number of photometric tests, the result of which averaged as follows:—

Foreign accumulators and bulbs when charged gave 0·92 c.p.; discharged, 0·89 c.p. Foreign accumulators with new English bulbs when charged gave 0·78 c.p.; discharged, 0·69 c.p. New English accumulators and new English bulbs when charged gave 0·83 c.p.

The procedure in the lamp room is as follows:—The shift's work below ground being over, the lamps are delivered at the appointed place. The lampman at once unlocks each one, passing the shield on one side and the accumulator on the other. The contact pins are then removed and put into a jar containing soda. Fresh pins are put into the accumulators, which are then arranged on the charging board. The current, at from 1 to 1½ amps., is switched on and each cell tested with the voltmeter, to see if they are working properly. If so, they are allowed to remain there from five to six hours, until they register 2·6 volts, at which point they are removed and put ready for work. All accumulators are washed out with clean spring water and refilled with acid once every month. All contact plates and pins are oiled each day with a mixture of engine oil and colza.

The subject of electric miner's lamps was also dealt with by Mr. J. George at a meeting of the Association at Edinburgh. The author admitted that the first cost of electric lamps was a little higher than that of flame lamps, but the better light resulted in cleaner coal and less liability to accident. The company which he represented had supplied 75,000 electric lamps, which were in daily use. It was a great advantage to have a lamp which did not go out suddenly when jerked.

COLLIERY TRAILING CABLES

A PAPER on this subject, by Mr. J. Bentham, was read recently before the Yorkshire Branch of the Association of Mining Electrical Engineers, in which he described the experiences of the new Sharlston collieries with various types of trailing cable. The original trailing cables used when electrical working was first introduced at these collieries thirteen years ago consisted simply of two vulcanised india-rubber single conductor cables tied together at intervals of about a foot with tarred string. These gave considerable trouble, and were afterwards enclosed in a hose-pipe, but this made them very unwieldy, and dirt and moisture used to collect inside the pipe. The next type tried was a pair of single conductor rawhide braided cables, which were abandoned owing to fondness of mice for the leather. A twin cable, sheathed with ordinary leather, answered well for a time in dry situations, but in damp places became mouldy and rotted through. Vulcanised rubber and bitumen insulated cables were next experimented with, but the chief drawbacks were: the conductor wires breaking, its unusual size owing to the extra bitumen sheath, the bitumen cracking inside the whipcord sheathing, and the whipcord sheathing rotting in damp positions. A rope winding over vulcanised rubber-insulated cable proved unsatisfactory owing to the rope getting cut and frayed and unravelling. The next type

tried was vulcanised rubber cable with a whipcord protection on it. Being without bitumen, this cable was more flexible, but there were troubles due to the conductor wires breaking and the rotting of the whipcord. These were used until "cab tyre" sheathed cables became available. The first cost of these is considerable, but they will outlast any of the others tried. The main features in which they could be improved were by the conductors being made more flexible and by having more of the cab tyre material between the conductors. In fact, he said that if the cab tyre sheathed cable were made with more flexible conductors, all the conductors farther apart, and more cab tyre in between and around all conductors, it would be ideal.

In the discussion, Mr. G. Preece said that Mr. Bentham's requirements could be met, but would increase the cost of the cables further. It was for the management of a colliery to consider whether it was better to lay out the money on one cable that would outlast four or five cheaper ones. Putting more insulation round the conductors would make the cable more unwieldy, and sacrifice flexibility, even though the conductors might be made up of finer wires.

LEAKAGE CURRENTS AND OIL

IN the course of a paper on the "Use and Abuse of Oils in Mining Plant," read recently before the West of Scotland Section of the Association of Mining Electrical Engineers, Mr. T. C. Thomsen referred to the effect on the oil in a generator bearing of currents through the bearing which would either be produced by leakage or, in the case of turbo-alternators, by currents induced in the shaft. When such currents are present, the oil, he says, will quickly darken in colour, increase in acidity, and throw down a deposit which will coat all parts of the turbine with which the oil comes in contact, lodging particularly in the oil cooler. This deposit is of a fairly hard, brittle nature, and of a dark chocolate colour; it is exceedingly difficult to remove, and is therefore very objectionable. The remedy is to insulate one of the generator main bearings completely from the turbine bedplate, including the connections between the oil pipes and that particular bearing. On rare occasions, local currents may cause corrosion of the oil tubes in the oil cooler, or of the turbine shaft and bearings, and even corrosion in the governor, causing the oil-operated piston to stick.

MINING CABLES

SOME interesting notes on electric cables for collieries are contained in a booklet that is being issued by W. T. Glover & Co., Ltd. (Trafford Park, Manchester). Trouble with mining cables is more often due to leakage currents than acid pit water, and the less fibrous material there is in the inner construction of a pit cable the better, particularly when a lead sheath is necessary, which is particularly liable to electrolytic attack. Of non-hygrosopic insulating materials, the choice is practically between rubber and bitumen, the former of which is seldom feasible owing to its cost. The early troubles of decentralisation have been overcome, and such cables are now able to withstand a very wide range of temperature. It has also been found possible to remove from multicore bitumen cables the fibrous tapes and wrappings which were formerly necessary to provide the insulation of the various cores with mechanical strength. A good example of the strength of the insulation of a modern bitumen cable is furnished by a case where five tons of cable fell down a 150-yard shaft, and the worst kinks in the tangled cable showed no short circuits, and only broke down at some thousands of volts when tested. The booklet goes on to urge the necessity for care in bonding and earthing. As regards making off in bye, two points should always be observed: the necessity of using totally enclosed switchgear and the undesirability of using rubber tails. To meet these requirements only such bifurcating or trifurcating boxes should be used as form in themselves an integral part of the switchgear carcase, and to this end, switchgear manufacturers cannot collaborate too closely with cable makers to meet the exact requirements of each individual order.

HAULAGE MOTOR CONTROL PANELS

HERE is a growing tendency to instal complete panels for the control of the motors in preference to ordering the controller, circuit breaker, ammeter, and other items separately, and mounting them on an improvised structure when they arrive on site. The General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.) have recently constructed, to the special requirements of a number of collieries, a form of control panel for haulage motors, which they have now standardised. In designing these panels, the aim has been to provide as compactly as possible a mistake-proof unit containing the whole of the motor control gear.

The unit consists of a strong frame carrying a grid type controller resistance, mounted on steel bars, and insulated by mica. The whole resistance is enclosed in a boiler plate cubicle, and on the front of the panel the controller is mounted, whilst the circuit breaker and ammeter, both of which are totally enclosed, are situated on top. There are no loose connections. The cables pass into a special terminal box, where they are firmly held, the strain being taken from the conductors by an armour clamp. The mistake-proof characteristics are added to by the inclusion of an electrical interlock between the circuit breaker and controller, which prevents the circuit breaker being closed with the controller in any other than the off-position. To facilitate transport along roads, the "Witton" panel is mounted on skids, and these are provided with bolts and rings to which the dragging ropes can be attached.

SELF-CONTAINED HAULAGE MOTOR CONTROL PANEL.

ated on top. There are no loose connections. The cables pass into a special terminal box, where they are firmly held, the strain being taken from the conductors by an armour clamp. The mistake-proof characteristics are added to by the inclusion of an electrical interlock between the circuit breaker and controller, which prevents the circuit breaker being closed with the controller in any other than the off-position. To facilitate transport along roads, the "Witton" panel is mounted on skids, and these are provided with bolts and rings to which the dragging ropes can be attached.

EXPLOSION-PROOF SWITCHGEAR

HE latest development in the extensive range of G.E.C. explosion-proof switchgear for fiery mines, made by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, E.C.), is the 20-ampere 500-volt double-pole explosion-proof switch with fuses shown in Fig. 1.

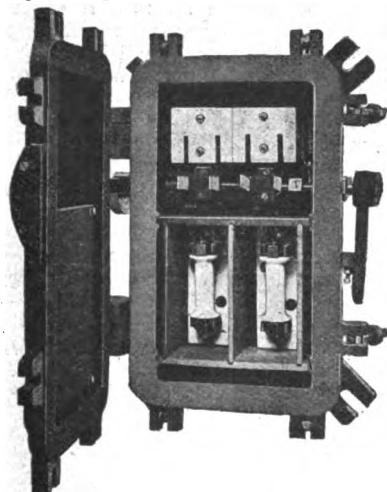


FIG. 1.—20 AMPERE EXPLOSION-PROOF SWITCH WITH FUSES.

It consists of a standard double-pole twinbreak switch, actuated by an external handle working through an explosion-proof gland. The interlock between the switch and the lid renders the apparatus mistake-proof. The fuses, which are of the standard bobbin type, are contained in a separate

fireproof compartment; arcing shields and thorough fire protection are provided throughout. If desired, the switch can be had without the fuses. In any piece of switchgear the three possible exits for the products of an explosion are the joint between the lid and the case, the point where the switch spindle passes through the case, and the cable entry. These details have been well considered. The joint between the lid and case is made by well-machined flanges, giving a close metal-to-metal joint, and in no place is the flange cut into for the purpose of taking the holding-down bolts. Special attention has been paid to the part where the switch spindle enters the case, this being the weakest point of many designs

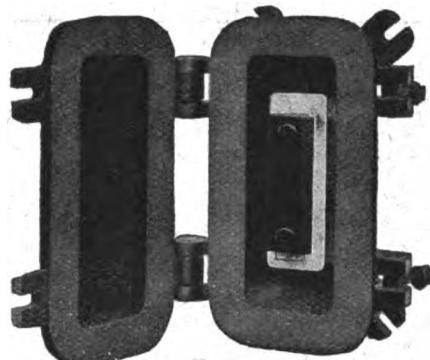


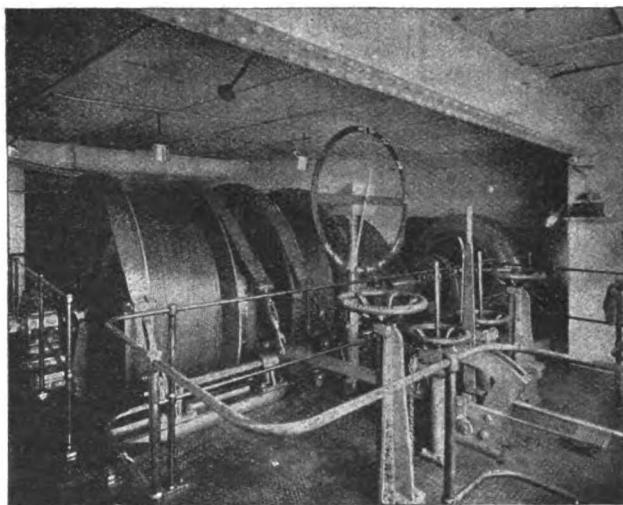
FIG. 2.—EXPLOSION-PROOF MINING FUSE.

of such gear, and a special flameproof gland is provided which entirely precludes the exit of the gases. The switch is designed to take the standard G.E.C. flameproof cable glands, which also afford a ready method of attaching the armouring of the cable to complete the earth connection.

Further additions to the range of mining gear are explosion-proof fuses, as shown in Fig. 2. These fuses are contained in flameproof cast-iron cases of substantial design. As in the switches, particular attention has been paid to the flame-proof flanges which effectively cool the products of any explosion inside the cases. The fuse-holders are of the Home Office bobbin type, and thoroughly protect the hand against dangers of shock or from the effects of a blowing fuse.

UNDERGROUND HAULAGE GEAR

AN example of a well-arranged electric haulage gear in the Seaton Burn Colliery is illustrated here. This has been designed to give a mean rope speed of 10 miles per hour, with a total length of rope of 4,500 yards. The haulage is driven by a 300-h.p. "Witton" slip-ring induction motor running at 290 r.p.m., and supplied at 2,750 volts, 40 cycles, from the mains of the Newcastle-on-Tyne Electric



300 H.P. HAULAGE GEAR AT SEATON BURN COLLIERY.

Supply Co. There are two drums, each 7 ft. in diameter on the roll, 10 ft. diameter over flanges, and 2 ft. 6 in. wide between flanges. They are made in halves. Between the motor and the haulage a Reich flexible insulated coupling is provided. A dial-type indicator is fitted to the main drum, and is driven through the drum boss by worm gearing.

The motor is controlled by a liquid controller designed so

that the motor can be started, stopped, reversed, and its speed regulated by a single lever. Movement of this from the "off" position first closes the oil-immersed stator or line switches. A further movement introduces a liquid resistance into the rotor circuit until the "full on" position is reached. All the parts are mechanically interlocked so that it is impossible for them to move in any but the correct order. Backward movement of the lever reverses the sequence of operations. In order to dissipate the heat generated in the liquid resistance when starting up, a special cooling system is included which effectively cools the liquid.

The General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), were the contractors for this electrical plant, and in addition to this gear have also recently supplied the electrical equipment for the conversion of two existing steam-driven haulages. A main-and-tail haulage, previously steam-driven, is now driven by a 150-h.p. "Witton" motor running at 300 r.p.m. off the 2,750-volt, 40-cycle supply. The control gear is similar to that described. A further conversion was an endless haulage working on the surface, which is now driven by a 75-h.p. "Witton" motor, and also controlled by a liquid controller.

Increased Charges for Electricity Supply.—The City of London Electric Lighting Co. notifies that as from the March meter readings electricity supplied for lighting purposes will be charged for in accordance with the existing sliding scale, the alternative fixed rates for general lighting supply being withdrawn. The sliding scale is 5d. per unit for the first six units per 30 watts of connected demand in each quarter, and 2d. per unit for all energy consumed in excess of such quantity per quarter. We understand also that all the other London companies have agreed upon an increase in their lighting charges. An increase of 10 per cent. in the power rates is notified by the Charing Cross, West End & City Electricity Supply Co., and presumably applies also to the City Co.

The main reason for the advance in price is the freight on coal, whilst, in addition, labour is now costing some 10 per cent. more owing to a war bonus. It is claimed that the increased charge to the consumer, however, only represents the extra freight charges.

The Work of the Patent Office.—The annual report of the Comptroller-General of Patents refers to the special legislation by which, during the war, patents held by enemies can be avoided or suspended or compulsory licences granted under them. Applications of this nature have been heard by the Comptroller and Sir Cornelius Dalton, and as a result 172 licences have been granted, two patents avoided, and one suspended by the Board of Trade. Corresponding arrangements have been made in relation to trade-marks, and certain extensions of time regarding the payment of fees and filing of documents have been made in view of the war. In the main, continues the report, the policy has been to attempt to carry on as far as possible all applications before the Patent Office, and even to receive further applications from alien enemies. No patent rights are, however, granted, and the question of extending the time for the doing of any act or the payment of any fees is considered only when the applicant is in a position to pay the fees or carry on proceedings. The policy of this emergency legislation has not been to confiscate patent rights owned by alien enemies, but rather to foster the sale and manufacture of goods by giving an effective security against any legal proceedings for infringement hereafter. With regard to the general trend of invention, naturally applications relating to naval and military subjects have increased considerably. The electrical industry as a whole is very prominent, there has been continued progress in automatic telephone systems, and attention has been given to receiving arrangements for cable telegraphy, and to ionised-gas relays for use in telephony and wireless receivers.

Dispute about a Welding Machine.—An action concerning a welding machine, which has just concluded after a long hearing before an official referee in London, must have cost many times the sum involved in legal expenses. The British Insulated and Helsby Cables, Ltd. in 1912 supplied the Crittall Manufacturing Co., of Braintree, Essex, with an electric welder for dealing with casement frames from 1 ft. to 10 ft. square at a cost of £444, the contract stipulating a capacity of twelve frames an hour and an accuracy at the weld of five-thousandths of an inch. It was alleged that the machine failed to carry out the contract conditions, and whilst the makers claimed for the value of the machine, the Crittall Co. counter-claimed damages. The official referee decided that the machine failed to fulfil the contract conditions, and that the defendants were not bound to accept it. It was alleged by the makers that the welder was put to do work for which it was never intended. The counter-claim for damages, however, failed.

PRACTICAL NOTES ON D.C. MOTORS

A PAPER containing many practical points on D.C. motors, by Mr. E. F. Butler, was read at a recent meeting of the Association of Supervising Electricians. After outlining the main features of series, shunt, compound, and interpole machines, the author dealt with features to be attended to in the selection of motors. All parts of the machine should be easily accessible by removable covers or otherwise, especially the commutator and brush gear. It was also an advantage to be able to remove the armature from either end. The brush boxes should be castings and not flimsy stampings, should be capable of using up nearly all of the brush, and should have as few parts as possible. For the bearings of small machines, he preferred hard brass to white metal, and they should be arranged so that they can be moved from either side of the end plate. Elaborate oil gauges were unnecessary, a short overflow pipe was all that was required. It was important that the shaft, where taken up by the pulley or pinion, should be less in diameter than the journal. In the case of ball bearings, it was important that one end should have a thrust bearing, and great care should be taken that no knock or jar can take place. Belts should be carefully spliced, and gear or direct driving machines should be provided, where possible, with flexible couplings. Starters required more attention than was often given them, and semi-automatic or totally automatic starters had great advantages. Of purely mechanical faults, oil throwing or creeping was the most common, the usual cause was the overflow being wrongly set. In enclosed machines with internal fans, worn bearings sometimes caused the shaft to drop, leaving a gap through which the oil is sucked, unless special means are taken for keeping it out. Wrong connections were an occasional source of trouble in new machines, but were not difficult to diagnose. Interpoles on compounding coils were sometimes reversed. Other troubles were short circuits and disconnections of field coils. In order to locate the fault, disconnect the coils halfway and test each half. If necessary, disconnect further until the faulty coil is located. In the case of short circuited coils, if a voltmeter is available, the voltage across each coil should be taken separately. A good set of coils will not vary more than about two per cent. This method is also useful in testing out coils suspected of being carbonised, or burnt internally. In this case if pressure is applied to the coil while the voltmeter is reading, any fluctuation in the reading will confirm this. After a run, a short circuited coil will feel colder to the touch than a good one. The speed also will be high, and the brushes nearest to the faulty coil will spark. Increase of speed in a compound machine may be due to the shunt and series winding being in contact. The most common fault met with is sparking, which can be due to a variety of causes, in addition to the wrong position of the brush rocker. Brushes may be making poor contact. The brush may have worn low, the brush spring may be resting on the edge of the brush box, the holder may be loose on the spindle, or the brush be sticking in the holder. The proper distance from the commutator to the bottom of the brush box should be from 1/8 to 3/16 of an inch. Worn bearings may set up sparking owing to an unequal distribution of the magnetic field. Bad condition of the commutator is also another common cause. The usual troubles with commutators are—the mica between the segments standing high, and low commutator bars or flats. Low bars may be due, either to mechanical damage, or to some segments being softer than others. Flats often develop from low bars, or may be set up by causes external to the motor. Bad joints in belts are a very common cause, pulleys out of balance, or badly cut gearing, are also usual. Sparking due to overload can easily be recognised, being accompanied by heating up of the windings, and a reduction of speed. An open circuit will show as a green flash, arcing all round the commutator. This fault must not be mistaken for a somewhat similar one, in which the spark is of a red or yellow colour. This is due to dirt collecting on a sticky commutator, and can be removed by persistent cleaning. Sparking sometimes occurs because too many brushes are fitted, and more often because there are too few. Sparking may also take place owing to brush spindles being too close together, or too far apart; there will be more sparking in the first case than the second. In motors of more than two poles the brush holders should be staggered so that the commutator is covered by brushes of each polarity.

Royal Institution.—Among the arrangements after Easter are two afternoon lectures by Prof. J. A. Fleming on "Photoelectricity," and a Friday evening discourse by Prof. O. W. Richardson on "Electrons and Heat."

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,436.

I have recently been testing a small four-pole revolving-armature three-phase generator (A.C.). During the tests the question arose as to whether the machine was star- or mesh-connected. Several methods of ascertaining this were suggested, but none gave conclusive results. Is there any conclusive test which can be simply applied?—C. W.

(Replies must be received not later than first post, Thursday, April 8th.)

ANSWERS TO No. 1,434.

I wish to recover copper from pickling vats, of which we have a large number, each 9 ft. by 4 ft. by 4 ft. It is desired to deal with the liquid from six such tanks per week. It is proposed to use an electrolytic recovery bath, 4½ ft. by 2½ ft. by 3 ft., with a lead lining, forming the cathode and carbon anodes. What voltage and current density will give the best results, and is the scheme likely to be commercially profitable? The solutions to be dealt with nearly reach saturation.—J. L. L."

The first award (10s.) is made to "L. R." for the following reply:—

An analysis of the scheme suggested will show that it cannot be commercially used without some modification. The pickling vats each hold 144 cubic feet, if for the purposes of calculation it be assumed that they are entirely full. Hence, for six vats, 864 cubic feet of liquid have to be dealt with per week; making the same assumption for the electrolytic bath and neglecting the volume of the anodes, it contains 33½ cubic feet, therefore, 26 baths have to be dealt with each week, or say four a day. Reckoning for the moment that working can take place over 24 hours, this means six hours are allowed for obtaining the copper from each bath, that is, 5·6 cubic feet, or $5\cdot6 \times 28\cdot3 = 158$ litres of liquid must be electrolysed per hour. Pickling liquid comprises a mixture of sulphuric and nitric acids, and, for the present purpose, neglecting the effect of the acid on the solubility of the copper salt, the electrolyte can be looked on as a saturated solution of copper sulphate in water. It therefore contains about 39 per cent. of CuSO_4 , of which about 40 per cent. is copper, so that one litre of the liquid will contain approximately 155 grams of copper. Thus, 24,600 grams of copper have to be deposited per hour. Now, 1 ampere will deposit from a cupric solution in one hour 1.183 grams, so that 20,750 amperes are required to deposit the above quantity. The area of the lead lining of the bath, counting sides and bottom, comes to 53½ square feet, so that the current density of the cathode is 390 amperes per square foot. Now, ordinary current density for depositing copper electrolytically varies between 9 and 14 amperes per square foot (and the voltage required is from 0·5 to 1·5 volts, but this is only important as affecting the current density). From this it will be seen that the scheme exactly as set forth cannot be practically used, as the density would be forty times the ordinary figure and the copper deposited useless. Copper can be deposited at the high density suggested, but

only if there be very quick motion between the electrolyte and the cathode. Either the cathode may be moved quickly, or the electrolyte may be squirted thereon in jets. These latter cases will alter the conditions considerably, because a lead-lined tank cannot be used for the electrode, special electrodes must be employed. Further, as soon as this kind of treatment is involved, the bath cannot be left without attention, so that it would not be practicable to use in all probability anything like a 24-hour treatment. It is possible to increase the electrode area very considerably without increasing the size of the bath, by suspending a number of plate cathodes in the same bath. In this way, by placing, say, nine sheets across the bath, each of which would act as a cathode on two faces, an additional 140 square feet or so of surface could be obtained. This would reduce the current density almost to a quarter, but then it would be much too high. Further, not so much liquid would be contained in the bath. Again, the number of baths could be increased. It is, therefore, clear that some alteration is necessary, and whether this can be effected depends on the particular plant available. Certainly, it is not likely that it can be done with a single bath as suggested. It is quite possible that in this particular case the simplest solution will be to deposit the copper chemically, for instance, by the action of sulphuretted hydrogen, which throws down the sulphide and works very quickly, but in that event it will be contaminated with free sulphur if much nitric acid be present, because this will oxidise the sulphuretted hydrogen.

No second award is made.

ANSWERS TO CORRESPONDENTS

ARC.—An open-type 10-ampere arc lamp will give approximately 800 lower mean hemispherical candle-power, allowing for the loss in the globe (although the maximum in a particular direction reaches some 1,800 c.p.). The five lamps take 2,500 watts, including watts lost in resistance, or 500 watts each, so that the efficiency of each may be stated as 0·625 watts per mean spherical candle-power. In comparing this figure with that for other methods of lighting, you must be careful to see that mean hemispherical and not mean horizontal nor maximum candle-power has been considered.

H. TAYLOR.—You must give us further particulars of the nature of the circuit to be tested before your question can be answered satisfactorily.

Insurance of Diesel Engines.—At the March meeting of the Diesel Engine Users' Association the question of insurance of Diesel engines against breakdown was discussed. It was reported that a considerable proportion of Diesel engine plants were uninsured against breakdown, in consequence of the high rates charged by insurance offices. In nearly all cases in which insurances had been effected, these included damage to surrounding property, and the proportion of the amount insured to the total value of the plant averaged 35 per cent., and the ratio of the annual premium to the actual amount insured varied from 3 to 7½ per cent. Members of the Association were asked to keep careful account of the cost of repairs, as these would be of considerable assistance to the Association in dealing with the general question of insurance against breakdown. A scheme of insurance against breakdown was then outlined, under which members of the Association would be able to obtain advantageous terms. The proposal was referred to the Committee for further consideration. The next meeting of the Association is to be held on Wednesday, April 21st, when a discussion will take place on the whole question of the lubrication of Diesel engines. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, at 19 Cadogan Gardens, S.W.

Volunteer Mechanical Transport.—The headquarters of the Mechanical Transport Column of the City of London National Guard Volunteer Corps have now been transferred to the offices of the Commercial Motor Users' Association (83 Pall Mall, S.W.). Colonel R. E. Crompton, C.B., has been appointed Hon. Commandant; Mr. E. S. Shrapnell-Smith, Commandant; and Mr. F. G. Bristow (Secretary of the C.M.U.A.), Adjutant of the Mechanical Transport Column. A composite convoy of the Column is conveying a number of members of the Guard to Brighton in connection with the Easter parades. The convoy will leave the Guildhall Yard on Wednesday next, the 31st inst., at 2.30 p.m., under the charge of the Adjutant, and will put down at the A.S.C., M.T. Garage, North Road, Brighton, by permission of Major W. Brailey, Officer Commanding. Owners of lorries who are willing to assist with the loan of their vehicles for subsequent Sunday parades are requested to make application to the Adjutant at 83 Pall Mall, S.W.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published March 25th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

5,511/14. Booster Transformers. B. HOLM-HANSEN. A booster or compound transformer having stationary primary and secondary windings, a series coil placed on a separate part of the core, and a movable armature without a winding dividing according to its displacement the flux induced by the shunt coil into two branches, one inducing a current in the series winding, the other having no inductive action, whereby the secondary E.M.F. is caused to vary in accordance with the position of the movable armature. (Two figures.)

5,583/14. Condensers. G. BURNSIDE and J. WALLACE. A method of manufacturing condensers in which the conducting plates are formed of layers of powdered metal spread upon the surface of, and cemented by, gold size or other suitable material.

6,739/14. Preparation of Nitrogen. B.T.-H. Co. (G.E. Co., U.S.A.). Isolation of the nitrogen from the air by leading air through an electrically-heated porous tube, causing a reducing gas, such as hydrogen, to enter the tube through the porous walls, and removing reaction products by known methods. This method is stated to produce nitrogen containing less than one half per cent. of oxygen. (Two figures.)

6,853/14. Incandescent Lamps. W. J. OWEN and C. DAMEY. Tubular lamps which can be arranged end to end in suitable fittings without wiring at intermediate points, as the feed wires are contained in the lamps themselves. (Three figures.)

14,595/14. Wireless Telegraphy. R. B. GOLDSCHMIDT. Elimination of extraneous signals by providing an intermittent contact maker putting the receiving apparatus in and out of operation at a frequency equal to a multiple or sub-multiple of that of the trains of waves to be received. (Two figures.)

22,270/14. Telephony. A. H. OTSSON and H. B. M. PLEIJEL. In self-induction coils for duplex telephone connections arranged on the Pupin system, the employment of two double coils inserted in each one of two double lines, and constructed in such a way that the duplex line is loaded by self-induction from the leakage field set up between the two coils by the current in the duplex line. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: HUGHES [Lamp suspension] 5,662/14.

DYNAMOS, MOTORS, AND TRANSFORMERS: TAYLOR [Frequency changing] 2,060/15.

Electrometallurgy and Electrochemistry: LANDRETH [Electrochemical treatment of liquids] 3,181/14; CÔTE and PIERRON [Zinc furnace] 14,192/14.

Switchgear, Fuses, and Fittings: B.T.-H. Co. (G.E. Co., U.S.A.) [Automatic regulators] 5,639/14; HOLT [Circuit-breakers] 6,070/14; ALLOM [Reflectors] 6,173/14; JOYCE and SPAGNOLETTI, LTD. [Controlling switches] 7,900/14; COX [Switches] 12,976/14; MAHONEY [Circuit interrupters] 16,318/14.

Telephony and Telegraphy: SHEPARD and McKECHNIE [Line or wireless telegraph systems] 28,277 and 28,278/13; WESTERN ELECTRIC CO. (Woodward for W.E. Co., U.S.A.) [Switches] 6,162/14; BETULANDER AUTOMATIC TELEPHONE CO. and AITKEN [Impulse transmitters] 6,209/14; OLSSON and PLEIJEL [Duplex and multiplex telephony] 22,133/14.

Traction: WOLFF (Fielding) [Signalling] 5,321/14; SHEPARD and McKECHNIE [Automatic braking] 5,869/14; ELECTRIC & ORDNANCE ACCESSORIES CO. and ETCHELLS [Vehicle lighting and heating switches] 6,180/14.

Miscellaneous: WAUCHOPE and STOHTERT & PITTS, LTD. [Safety devices for electric winding mechanism] 8,286/14; FOURNIER d'ALBE [Apparatus for reading by the ear] 10,368/14; GILES [Condensers] 10,895/14; DU BOIS [Electrical egg-testers] 12,804/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps, &c.: PLANIWERKE A.G. FÜR KOHLENFABRIK [Negative carbon for heavy currents] 15,485/14.

DYNAMOS, MOTORS, &c.: VULCAN WERKE HAMBURG & STETTIN A.G. [Motor control] 12,048/14.

Miscellaneous: RICHARD-GINORI [Insulators] 3,369/15.

Opposition to Grant of Patents

24,755/13. Insulators. F. HANDCOCK. The appeal against the Comptroller's decision to allow the grant of a patent on this application, in spite of opposition, has been withdrawn. The specification describes a tool for boring holes in porcelain insulators during manufacture.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

6,947/01. Overhead Conductors. C. DE KANDÓ. Suspension of overhead contact lines for electric railways in which springs or other devices are provided to take up slack and keep a constant tension on the wire under varying temperature.

7,224/01. Lead Covering for Cables. E. A. CLAREMONT and J. STRATTON. Improvements in the construction of dies and cores for lead presses.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: J. STRATTON and E. A. CLAREMONT [Cable connector] 26,796/08.

DYNAMOS, MOTORS, AND TRANSFORMERS: HARLÉ & CIE [Motor control] 28,164/09.

Electrochemistry and Electrometallurgy: J. M. BAUDOT [Electrolytic treatment of wool] 25,681/05; E. WASSMER [Electric furnaces] 28,813/09.

Instruments and Meters: E. T. R. MURRAY [Maximum demand indicators] 28,947/09.

Switchgear, Fuses, and Fittings: B.T.-H. Co. (G.E. Co., U.S.A.) [Circuit breakers] 25,512/05.

Telephony and Telegraphy: E. W. SCHNEIDER [Telephones] 25,879/06; E. E. CLEMENT [Automatic telephones] 28,091/06; B. ROSING [Transmission of pictures] 27,570/07.

Miscellaneous: F. POWELL [Magnetic separator] 27,020/08; B. TRAUTMANN [Burglar alarms] 28,638/09; V. COURTECISSE [Number signs] 28,842/09.

The L.C.C. Power Scheme.—To fill vacancies on the L.C.C. Special Committee on London's electricity supply, it is proposed that Messrs. G. M. Gillett, H. H. Gordon, and the Hon. Gilbert Johnstone be elected. It may be remembered that after the L.C.C. decided to proceed with its Bill this session, Mr. H. H. Gordon, who has been so intimately connected with the Stepney electricity undertaking for many years and was strongly opposed to the scheme, resigned from the Committee.

Northampton Polytechnic.—The course of advanced lectures on "Electrical Instruments and Switchgear," by Mr. A. C. Heap, which was announced to be given at the Northampton Polytechnic Institute during the spring, has had to be cancelled, as urgent engagements caused by the war make it impossible for Mr. Heap to undertake it at the present time.

Osram Lamp Works and the War.—The employees of the Osram & Robertson Lamp Works have collected by weekly subscriptions up to now a total of £349 9s. 9d. towards the Prince of Wales War Relief Fund. Seventy-three men from the lamp works have joined H.M. Forces, and information has been received of four cases of their men being wounded. Fortunately, so far, no fatality has been reported.

Junior Institution of Engineers.—A Paper on "Electrical Heating and Cooking Apparatus," by Mr. S. M. Hills, dealing in a comprehensive way with radiators, &c., cooking apparatus, and water heaters, will be read at a meeting of the Junior Institution of Engineers on Monday, April 12th. Tickets can be obtained from Mr. A. Clifford Swales, secretary, 39 Victoria Street, S.W.

EXTENSIONS AT IPSWICH

EXTENSIONS to the electric supply system of the Ipswich Corporation have recently been completed and put into operation, whereby the whole of the eastern district of the town, which is largely residential, has been provided with an electric supply from 4-wire 3-phase low tension mains, at a pressure of 400 volts between phases, or 230 volts from any phase to neutral. 5·2 miles of main have already been laid. The district is supplied from two brick-built static transformer sub-stations, which are fed from duplicate 3-phase feeders at 3,000 volts. On their way to the eastern district, the duplicate feeders, which are each 2·75 miles long, are looped into a rotary converter sub-station in the foundry district, designed to supplement the existing continuous current supply to the consumers in that neighbourhood. The 3-phase supply at the power station is at present provided by a rotary converter, running inverted on the D.C. supply, and having a normal alternating current output of 312 K.V.A. As a stand-by for this, there is a 300 K.V.A. 3-phase alternator connected to one of the original Reavell tandem compound three-crank engines running at 375 r.p.m. Automatic voltage regulation is provided for on both the rotary and alternator by means of a Taylor-Scotson regulator, this being the third of that make of regulator installed at Ipswich. The two rotary converters in the foundry district sub-stations are arranged for a normal output of 250 K.W. The whole of the generating and converting plant has been supplied by the British Westinghouse Electrical Manufacturing Co., the main switchboards were supplied by the Switchgear Construction Co., of Birmingham and London, and the transformers in the static sub-stations were supplied by Messrs. Ferranti, under the supervision of Mr. F. Ayton, Chief Engineer and Manager, Ipswich Corporation Electric Supply and Tramways Department.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"The Universal Electrical Directory (J. A. Berly's), 1915." 1,554 pp. 9 $\frac{1}{2}$ in. by 6 $\frac{1}{2}$ in. (London : H. Alabaster, Gatehouse & Co.) 21s. British and Colonial Sections only 12s.

Pitman's Shorthand Writers' Phrase Book and Guide—Civil Engineering. 88 pp. 6 $\frac{1}{2}$ in. by 4 $\frac{1}{2}$ in. (London : Sir Isaac Pitman & Sons, Ltd.) 1s. 6d. net; by post, 1s. 8d.

"A Treatise on the Theory of Alternating Currents." By A. Russell. Vol. 1. 534 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. 163 figures. (Cambridge : The University Press.) Second edition. 15s. net; abroad 15s. 8d.

"The Mathematical Analysis of Electrical and Optical Wave-motion." By H. Bateman. 159 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. 6 figures. (Cambridge : The University Press.) 7s. 6d. net; abroad 7s. 10d.

"Modern Illuminants and Illuminating Engineering." By L. Gaster and J. S. Dow. 462 pp. 9 in. by 6 in. 204 figures. (London : Whittaker and Co.) 12s. 6d. net; abroad 13s. 6d.

ELECTRIC TRACTION NOTES

At a meeting of the Birmingham Local Section of the Institution of Electrical Engineers, to which members of the Institution of Railway Signal Engineers and local members of the Institution of Mechanical Engineers were invited, Mr. W. C. AfIELD read a paper on the development of main line signalling on railways. After explaining the objects of the original "block" and "lock and block" systems, and a modified "interlocking block" system, giving greater freedom in handling mixed traffic, he remarked that the weak spot in these systems was the possibility of misuse of the cancelling key. He described the leading features of ordinary semaphore, dwarf, and other signals, referring to the growing movement for the abolition of the distant signal, and the simplification of large station signal equipment by illuminated route indicators. The interlocking of levers and actuating mechanism was then dealt with, and the tablet and staff systems for single-line working were described, together with the modifications in ordinary gear required for reversible working. Coming to more modern developments, the author said that, although train stops were satisfactory for electric traction at moderate speeds, it was in-

creasingly difficult to design such apparatus as the speed increased. He suggested that the solution of the problem lay at present rather in cab signalling. The most important recent innovation was track-circuiting, the possibilities of which for effecting all kinds of interlocking were enlarged upon. Various matters were dealt with under the heading of prevention of accidents, including special methods of protection of trains detained at signals. The author described the general principles of an automatic train control and audible cab-signal system, and also referred to the Kramer "Railophone" inductive signalling system. The main features of semi-automatic and fully-automatic signalling were described, the latter being preferably of the "normally clear" rather than the "normally danger" type. The author was strongly in favour of the use of upper quadrant three-position signals, and among other recent developments mentioned the use of yellow instead of red lights for distant signals. Finally, he discussed methods of power signalling, including the electro-pneumatic, low-pressure pneumatic, and all-electric systems, comparing the check, lock, and constant detection systems of indicating that the desired movements have been accomplished.

H.M. Treasury has indicated that it is unable to consent to Clause 25 of the L.C.C. (Tramways and Improvements) Bill, which authorises an expenditure of £271,900 for tramway extensions. The Council are urged to postpone, as far as possible, all new capital expenditure, and to limit expenditure, as far as possible, on works already in progress.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

An article in the *Sweizerische Elektrotechnische Zeitschrift* deals with the danger from sparking from wireless telegraph apparatus in balloons. The matter is discussed from several aspects, and finally the following precautions are recommended. The sending apparatus must be such that no open sparking is produced by the wave generator. In view of possible brush discharges from the ends of the antenna, the ends of the upper part of the antenna must be kept as far from the body of the balloon as possible, and an upper antenna of very considerable capacity is advisable. Undamped waves are preferable to strongly damped waves, as they do not entail such high voltage in the antenna. All leads in connection with the antenna must be carefully coupled up so that no contact can cause sparking by working loose. In order to prevent surges, all metal framework of the airship should be connected to the antenna, and there must be no sharp corners likely to produce brush discharges. The sending apparatus must, in no case, be used when gas is escaping from the balloon during descent.

The directors of Marconi's Wireless Telegraph Co. have issued a statement in which, after notifying a dividend of 7 per cent. on the cumulative participating preference shares, it is stated that no interim dividend can be declared on the ordinary shares owing to practically all the Company's business now being on behalf of the Government, and the question of compensation not having yet been settled. The new direct public service with New York, which had been expected to be opened last summer, has necessarily had to be postponed.

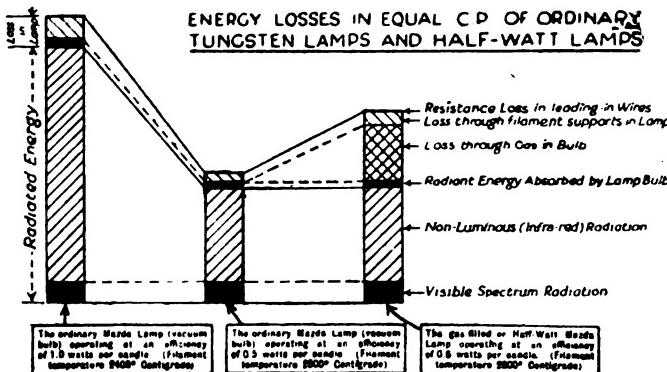
At the annual meeting of the Automatic Telephone Manufacturing Co. last week, Mr. James Taylor said that the four exchanges at Epsom, the G.P.O., Simla, and Cordoba (Argentina), continued to give every satisfaction. Exchanges had recently been completed at Rosario and Accrington. The company has also in hand exchanges for Leeds, Newport, Blackburn, Chepstow, Paisley, and Portsmouth, all of which are in an advanced state of progress.

An action against Marconi's Wireless Telegraph Co., by Mr. J. W. Hamilton, has just concluded in the High Courts. It was to recover damages for alleged wrongful termination of a contract by which Mr. Hamilton was appointed sole agent for the Marconi Co. in Australasia for a period of three years. The case lasted some three weeks, and Mr. Justice Avory, in his summing-up, referred to it as "a most wearisome case," and one "possessing no feature of human interest." The Company justified the termination of the contract, and counter-claimed for damages, but in the end, judgment was entered for Mr. Hamilton for £2,640. There will probably be an appeal.

Telephone communication has been established between Johannesburg and Kimberley, a distance of 810 miles at a charge of 2s. 9d. for a three-minutes' conversation.

ENERGY LOSSES IN INCANDESCENT LAMPS

THE accompanying diagram gives an interesting comparison of the efficiencies of half-watt (gas-filled) and other metal filament lamps. The columns show the losses occurring in the ordinary vacuum lamp when worked at an efficiency of one watt per candle and at 0·5 watts per candle as compared to the losses in the gas-filled or half-watt lamp at an efficiency of 0·6 watts per candle. This diagram was recently presented in a paper before the Chicago Engineering Society by Mr. S. E. Doane. The vacuum lamp, when worked at an efficiency of 0·5 watts per candle, shows smaller losses than the gas-filled lamp, due to the energy loss in the gas employed in the gas-filled lamp. As is well



known, however, the ordinary metal (vacuum) lamp, worked at such an efficiency as 0·5 watts per candle, would give only a life of a few hours. On the other hand, the gas-filled (half-watt) lamp is able to work at this high efficiency with satisfactory life, because of the neutral gas with which the bulb is filled, which prevents volatilisation of the filament. Energy losses due to the inert gas in the gas-filled lamp are, of course, unavoidable, but in spite of these losses, the diagram shows that the gas-filled or half-watt lamp makes a marked advance in efficiency over the ordinary vacuum lamp as used commercially.

CATALOGUES, PAMPHLETS, &c., RECEIVED

LOOM MOTORS.—A descriptive price list of three-phase squirrel-cage induction motors for the individual drive of looms has been issued by the British Thomson-Houston Co., Ltd. (Rugby). These are of the fully-enclosed type, with ball bearings, and are hinged to their base plates and provided with a spring regulating the belt tension. A special form of enclosed starting switch, built on the lines of a drum-type controller, is made for use with these motors. Six sizes are standardised,

• from $\frac{1}{2}$ to $1\frac{1}{2}$ h.p.

FITTINGS FOR HALF-WATT LAMPS.—A leaflet from Engineering & Arc Lamps, Ltd. (Sphere Works, St. Albans), illustrates a number of fittings for half-watt lamps made entirely at the St. Albans works. A very comprehensive range is included suitable for street, railway, works, or shop lighting. These fittings appear well designed and substantial, and a point worth noticing is the way in which the globe is carried on a cast-iron ring, having a wide hinge so that only one hand is required to open and to close the fittings. Some of the fittings carry hexagonal lanterns instead of globes. Internal cut-outs and substitutional resistances are arranged, and can be provided so that arc lamps can be replaced without alteration to the wiring.

SMALL AUTOMATIC TELEPHONE EXCHANGES.—In our issue of February 26th, 1914, in describing the automatic telephone exchange system of Siemens Bros. & Co., Ltd. (Woolwich, S.E.), we referred to the small automatic switchboards designed for village exchanges which the firm was then developing. These, as mentioned in ELECTRICAL ENGINEERING, February 18th (p. 73), are to be tried in six villages by the Post Office. A pamphlet describing the system has now been issued by the firm.

VACUUM CLEANERS.—We have received from Gillespie & Beales (Amberley House, Norfolk Street, Strand, W.C.) leaflets relating to the "Nilfish" electric suction cleaner, which has several special features. It is a neatly designed, portable machine which stands on the floor and works with a hose, and has the dust bag enclosed within a cylindrical case, in the upper portion of which is the high-speed motor with its two-stage turbine fan. A particularly large volume of air is swept through, which clears away more dust for the power exerted than do machines employing a higher vacuum with less flow of air. The outfit weighs 35 lbs. and consumes 300 watts.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aldershot.—The Electricity Department requires a 400 kw. D.C. turbo-generator, water-tube boiler, and water softening plant. Borough Electrical Engineer. May 4th.

Basingstoke.—Sanction has been received from the L.G.B. for the laying of a cable to supply Messrs. Thornycroft & Co. with 250,000 units per annum.

Bedford.—A new sub-station is to be constructed.

Bristol.—Twelve months' supply of electric lamps for the Docks. Engineer, 19 Queen Square.

Haslingden.—Sanction has been received for carrying out certain important works in connection with the electrical undertaking, for which borrowing powers of £12,000 were recently sought.

Llandudno.—The L.G.B. having refused to sanction a loan of £2,000 for new plant, the Council has decided to proceed with the scheme nevertheless, and to pay for the plant out of reserve.

London: Battersea.—The Treasury has consented to a loan of £5,000 for meters.

Hampstead.—A number of rubber services are to be renewed with lead-covered armoured paper-insulated cable. The work is to be spread over three years and the cost met out of reserve.

Hammersmith.—The Treasury has consented to a loan of £10,000 for electrical extensions.

Ripon.—Mr. G. Wilkinson, the Harrogate Borough Electrical Engineer, is preparing a report upon an electric lighting scheme.

Sheffield.—An inquiry was held yesterday concerning a loan of £85,400 for electrical extensions.

Wiring

Barnet.—The North Metropolitan Electric Power Distribution Co. is to supply electricity for the infirmary for a period of seven years at 1d. per unit plus a standing charge of £50 per annum.

Bingley.—Wiring of Victoria Hall. Mr. Hopewell, 62 Main Street.

Rhondda.—Eighty-eight lighting points at the Council's offices. Borough Electrical Engineer. April 17th.

Salford.—Church of Ascension, Broughton.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Runcorn.—Additions to hospital. Mr. Wilding, Town Hall.

Smethwick.—Considerable additions to Smethwick and Oldbury Joint Hospital. Borough Surveyor.

Stoke-on-Trent.—County Mining Institute. Director of Education, Stafford.

Miscellaneous

Australia.—The Deputy Postmaster-General, Melbourne, requires 200 telephone transformers.—Motor equipments and magnetic brakes are required by the Hawthorn Tramways Trust. Further particulars in both cases at 78 Basinghall Street, E.C.

Batley.—Twelve months' supply of stores. Borough Electrical Engineer. April 7th.

Blackburn.—Electrical instruments are required at the County Asylum, Whalley. Steward.

Bradford.—Tramcar trucks, motors, controllers, and automatic circuit breakers are required by the Tramways Department. Tramway Manager. April 17th.

Stirling.—Owing to the difficulty of obtaining arc lamp carbons, the Borough Electrical Engineer has reported upon the replacement of the whole of the arc lamps, sixty in number, by half-watt 600 c.p. incandescent lamps. He puts the cost at £168, but estimates that there will be an economy in current and carbons of between £80 and £90 per annum. The work is to be carried out and the expense charged to revenue.

Siemens Rifle Club Social Evening.—The present season's membership of the Siemens Dalston Miniature Rifle Club forms the record since its inception, and some twenty-three past members of the Club are now serving with the Forces. A social evening was held at Mozart House on Friday last, under the auspices of the Club, and was enjoyed by a party of about 150 members and friends. Mr. A. E. Holmes distributed the medals and spoons won during the current half-season. Vocal and instrumental items were interspersed with dancing, and the success of the evening is largely due to the efforts of Mr. F. S. Dennison, who acted as Hon. M.C.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Barking.—The recommendation of the Acting Electrical Engineer to purchase a Ljungstrom turbine (Brush Electrical Engineering Co.) has been adopted.

Bootle.—The following tenders have been accepted:—Cables and stoneware troughing, Callender's Cable and Construction Co.; meters, B.T.-H. Co. and Reason Manufacturing Co.; fuse boxes and terminals, British Insulated & Helsby Cables, Ltd.; oils, Vacuum Oil Co.; bitumen and compound, Trinidad Lake Asphalt Co.; service boxes, E. Wilson & Co.; electric globes, General Electric Co.

Manchester.—A contract has been placed with Messrs. Chamberlain & Hookham for a twelve months' supply of tramcar meters.

APPOINTMENTS AND PERSONAL NOTES

Mr. James Bird, at present Deputy Clerk to the London County Council, has been appointed to succeed Sir Laurence Gomme as Clerk at a salary of £1,600 rising to £2,000 per annum.

The late Mr. J. F. Albright, Chairman of the British Electric Transformer Co., left estate valued at £33,854, of which the net personalty is £32,601.

The late Mr. W. Bullock, Manager of the Electric Construction Co.'s Works, left estate of the gross value of £6,883, of which £6,630 is net personalty.

Particulars appear in our advertisement columns of a number of central station and other appointments.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £76 to £76 10s. (last week, £74 10s. to £75).

Australian Agency.—An agent in Melbourne desires to represent United Kingdom manufacturers of electric cranes. Further particulars at 73 Basinghall Street, E.C.

London Office.—Parmiter, Hope & Sugden (Hulme Electrical Works, Manchester) have opened a London Office at Queen Anne's Chambers, Westminster, under the direction of Messrs. Nathan & Allen, where samples of their new "Fluvent" fuse system may be seen.

LOCAL NOTES

Bexley: New Plant.—A 500 kw. Westinghouse turbo-generator, the turbine being of the Rateau type, was put into service at the electricity works last week. In conjunction with this set a Stirling water-tube boiler has been installed. This scheme of extensions has been carried out under the supervision of Mr. H. P. Stokes, the Borough Electrical Engineer.

Canada: Ontario's Electrical Development.—The Ontario Hydro-Electric Commission is now supplying current in bulk to three towns, 102 municipalities, and some 800 rural in-

dustrial enterprises. The quantity of electricity distributed amounts to 100,000 h.p. The Chairman of the Commission (Sir Adam Beck) recently stated that the Province of Ontario will soon have 1,000 miles of State-owned electric railways.

Edinburgh: The I.M.E.A. Conference.—The recommendation of the Electricity Committee that Bailie Stevenson and the City Electrical Engineer be sent to the I.M.E.A. Conference in June was opposed by Councillor Robertson. The expense involved was characterised as extravagance, but on a vote the recommendation was agreed to by 20 votes to 12.

Ireland: Water-Power Electricity.—It is stated that a scheme of some magnitude for generating electricity by water power in Ireland is in contemplation. The waters of Lough Erne and the Shannon are referred to. Presumably the scheme is on the lines of the large power companies in this country, for it is stated that a power station at Limerick could supply electricity for Dublin and the southern half of Ireland, but that there will be no competition with existing undertakings. A capital of between one and two million pounds is mentioned.

Kingston: Chairman's Resignation.—In consequence of the Council's decision to impose a 10 per cent. increase on all classes of consumers instead of an increase of from 5d. to 6d. in the flat rate for lighting purposes, as recommended by the Electricity Committee (see ELECTRICAL ENGINEERING, March 25th, p. 136), the Chairman of the Electric Lighting Committee has resigned, says the *Surrey Advertiser*.

London: Poplar.—It is announced that there will be a reduction in the charge for private lighting from 4d. to 3d. per unit as from the end of March.

Stoke Newington: Loan Sanctioned.—The Treasury has sanctioned loans of £3,000 for mains and £1,000 for meters. It appears that this amount has already been spent without approval, and the Treasury has only given its sanction on the assurance of the Borough Council that no further capital expenditure will be incurred during the war which is not really necessary in the national interests.

Worcester: Loans.—An inquiry was held last week concerning loans of £5,250, £1,973, and £850 for the electrical undertaking. Naturally the question of the Treasury consent was raised, and Mr. H. R. Hooper, the Inspector, intimated that the application for £4,000 of the first-named sum required for mains must be withdrawn. He emphasised, as we have already pointed out in our columns, that the ordinary developments of the undertaking must wait until after the war. There is a sum of £838 over expenditure on mains and £116 over expenditure on sub-station equipment. These items are to be the subject of a special report to the L.G.B.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

North Metropolitan Electric Power Supply Co.—A dividend of 6 per cent. and a bonus of 12s. per share is declared on the ordinary shares for 1914, after placing £2,000 to reserve for redemption of debentures and £1,624 to depreciation, making the latter £100,000. The carry forward is £4,677.

British Aluminium Co.—The year 1914 was the best in the records of this company, notwithstanding the difficulties introduced by the war. A dividend of 5 per cent. less tax is paid on the ordinary shares.

British Insulated & Helsby Cables.—Dr. E. K. Muspratt, the Chairman, at the annual meeting last week, stated that although the company had had a very busy year and had made £30,000 more profit than in 1913, this was not due to orders for war supplies. Business with neutral countries had expanded very considerably, and the unexecuted orders on hand at the present time were more than ever before. In view of the prosperous position the sum of £25,000 has been set aside for the formation of a pension fund.

Brush Electrical Engineering Co.—At the meeting on Monday the report and accounts given in our last issue were adopted. Mr. E. Garcke, who presided, said that the directors would have been perfectly justified in declaring a moderate dividend on the ordinary stock, but they felt that war time was not one for a company which had only just emerged from a long period of depression to begin the payment of dividends.

British Westinghouse Co.—At the meeting on Monday the Chairman, Mr. J. Annan Bryce, warned the shareholders against any anticipations of large profits from war contracts. Such contracts were by no means profitable. The satisfactory result of 1914 was, he said, due entirely to contracts entered into before the war, but there was a prospect of the company being adversely affected in the future owing to the war. He anticipated a period of general industrial depression after the war.



TRADES DIRECTORY OF ADVERTISERS IN "ELECTRICAL ENGINEERING."

(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).

Benjamin Electric, Ltd., 1a, Rosebery Avenue, E.C.
Drake & Gorham, Ltd., 66, Victoria St., S.W.
Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Guilbert-Martin, 9, Edmund Place, E.C.
Haslam & Stretton, Ltd., 11, Windsor Place, Cardiff.
Lundberg (A. P.) & Sons, Liverpool Rd., N.
Morris & Lister (London), Ltd., 4, Palace Chas., Westminster, S.W.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Simpson (C. M.), 4, St. Augustine's Place, Bristol.
Sun Electrical Co., Ltd., 118, Charing Cross Rd., W.C.
Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.

ACCUMULATORS, &c.

D.P. Battery Co., Ltd., Bakewell, Derbyshire.
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
Naylor Battery Co., 1, Lammermoor Rd., Balham, S.W.
Tudor Accumulator Co., Ltd., 3, Central Buildings, Westminster.
ARC LAMPS, CARBONS, AND ACCESSORIES.
Drake & Gorham, Ltd., 66, Victoria St., S.W.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
London Electric Firm, Croydon.
Oliver Arc Lamp, Ltd., Cambridge place, Burrage Rd., Woolwich.

ARMATURE REPAIRS.

Marryat & Place, 28, Hatton Garden, E.C.

BOILERS.

Babcock & Wilcox, Ltd., Oriel House, Farringdon St., E.C.

CABLES, WIRES, AND DUCTS.

Drake & Gorham, Ltd., 66, Victoria St., S.W.
Glover (W.T.) & Co., Trafford Park, Manchester.
Henley's (W.T.) Telegraph Works Co., Ltd., Blomfield St., E.C.
Hooper's Telegraph & India-rubber Works, Millwall Docks, E.
Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
St. Helens Cable & Rubber Co., Ltd., Warrington.
Siemens Bros. & Co., Ltd., Woolwich.
Union Cable Co., Ltd., Dagenham Dock, Essex.

CASTINGS, &c.

Dore (J.) & Co., Bromley, E.

CATALOGUES AND PROCESS ENGRAVING.

Swain (John) & Son, Ltd., Shoe Lane, E.C.

COIL WINDING.

Varley Magnet Co., Ltd., Cambridge Place, Burrage Rd., Woolwich.
CONDENSERS (Electrical).

Telegraph Condenser Co., Ltd., Vauxhall St., Kennington Oval, S.E.
DYNAMOS see Motors and Dynamos.

FLEXIBLE METALLIC TUBING.

United Flexible Metallic Tubing Co., Ltd., 112, Queen Vict. St., E.C.

HEATING AND COOKING APPARATUS.

Belling & Co., Lancaster Works, Derby Rd., Edmonton, N.
British Thomson-Houston Co., Ltd., Rugby.
Drake & Gorham, Ltd., 66, Victoria St., S.W.
Ferranti, Ltd., Central House, Kingsway, W.C.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
London Electrical Trading Co., Ltd., 185, Wardour St., W.C.
Townshend's Art Metal Co., Ltd., Ernest St., Birmingham.

INSTRUMENTS.

Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
Ferranti, Ltd., Central House, Kingsway, W.C.
Kelvin, Bottomley & Baird, Ltd., 18, Cambridge St., Glasgow.
Nalder Bros. & Thompson, Ltd., 97a Dalston Lane, Dalston, N.E.
Record Electrical Co., Ltd., Caxton House, Westminster, S.W.
Weston Electrical Instrument Co., Audrey House, Ely Place, E.C.

INSULATING VARNISH, ENAMELS, PAINTS AND LACQUERS.

Blume (Chas. H.), The White Building, Sheffield.
Fredk. Crane Chemical Co., Armoury Close, Birmingham.
Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.
Syrolit, Ltd., 69, Mark Lane, London, E.C.

INSULATORs AND INSULATING MATERIALS.

Macintyre (J.) & Co., Ltd., Burslem.
Mosses & Mitchell, 122 to 124, Golden Lane, E.C.
Weidmann (H.), Rapperswil, Switzerland.

INSURANCE.

Phoenix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LADDERS.

Heathman & Co., 10, Parsons Green, S.W.

LAMPS (Incandescent).

British Thomson-Houston Co., Ltd., 77, Upper Thames St., E.C.
Cryselco, Ltd., Kempston Works, Bedford.
Drake & Gorham, Ltd., 66, Victoria St., S.W.
Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.
General Electric Co., Ltd., 67, Queen Victoria St., E.C.
London & Rugby Engineering Co., Ltd., 36 & 37, Queen St., E.C.

LAMPS (Incandescent—contd.).

Pope's Electric Lamp Co., Ltd., Hythe Rd., Willesden, N.W.
Siemens Bros. Dynamo Works Ltd., Tyssen St., Dalston, N.E.
Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
Stearns Electric Lamp Co., Ltd., 47, Victoria St., S.W.

LAMP FILAMENTS.

Gmür & Co., Ltd., Aarau, Switzerland.

LEAD, &c.

Capper, Pass & Son, Ltd., Bedminster Smelting Works, Bristol.

LIFTS.

Waygood-Otis, Ltd., Falmouth Rd., S.E.

METERS.

Bastian Meter Co., Ltd., Kentish Town, N.W.

British Thomson-Houston Co., Ltd., Rugby.

Ferranti, Ltd., Central House, Kingsway, W.C.

MICA.

British Mica Co., Ltd., Lebanon Rd., Works, Wandsworth, S.W.
Wiggins (F.) & Sons, 102 to 104, Minories, E.C.

MINE EQUIPMENTS AND APPARATUS.

General Electric Co., Ltd., 67, Queen Victoria St., E.C.
Peebles (Bruce) & Co., Ltd., Edinburgh.
Reyrolle & Co., Ltd., Hebburn-on-Tyne.
Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.
Switchgear & Cowans, Ltd., Springfield Lane, Salford, Manchester.
Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.

British Thomson-Houston Co., Ltd., Rugby.

Crompton & Co., Ltd., Chelmsford.

Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.

Drake & Gorham, Ltd., 66, Victoria St., S.W.

Langdon-Davies Motor Co., 110, Cannon St., E.C.

Matthews & Yates, Ltd., Swinton, Manchester.

Peebles (Bruce) & Co., Ltd., Edinburgh.

Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.

Vickers, Ltd., River Don Works, Sheffield.

OIL CANS.

Kaye (J.) & Sons, Ltd., Lock Works, Leeds.

POCKET LAMPS.

Wilson (L. E.) & Co., 10, Corporation St., Manchester.

PUMPING PLANT.

Merryweather & Sons. Fire Engine Works, Greenwich, S.E.

Willans & Robinson, Ltd., Rugby.

REPAIRS.

Marryat & Place, 28, Hatton Garden, E.C.

RUBBER GLOVES.

Ingram (J. G.) & Son, Hackney Wick, N.E.

Moseley (D.) & Sons, Ltd., Ardwick, Manchester.

STEAM ENGINES AND TURBINES.

Allen (W. H.) Son & Co., Ltd., Queen's Engineering Works, Bedford.

British Thomson-Houston Co., Ltd., Rugby.

Dick, Kerr & Co. Ltd., Abchurch Yard, E.C.

J. Howden & Co., Ltd., 195, Scotland St., Glasgow.

Vickers, Ltd., River Don Works, Sheffield.

Willans & Robinson, Ltd., Rugby.

STEAM ENGINE ACCESSORIES.

Lea Recorder Co., Ltd., 32, Deansgate, Manchester.

United States Metallic Packing Co., Ltd., Bradford.

SWITCHGEAR.

Bill (S.) & Co., Ltd., 49, Queens Rd., Birmingham.

British Thomson-Houston Co., Ltd., Rugby.

Dorman & Smith, Ltd., Ordsall Electrical Works, Salford

Drake & Gorham, Ltd., 66, Victoria St., S.W.

Electric Control, Ltd., 177, Reid St., Bridgeton, Glasgow.

Ellison (George), Warstone Lane, Birmingham.

Ferranti Ltd., Central House, Kingsway, W.C.

Record Electrical Co., Ltd., Caxton House, Westminster, S.W.

Reyrolle & Co., Ltd., Hebburn-on-Tyne.

Switchgear & Cowans, Ltd., Springfield Lane, Salford, Manchester.

TECHNICAL BOOKS.

Caxton Publishing Co., Clun House, Surrey St., Strand, W.C.

Constable (Archibald) & Co., Ltd., 10, Orange St., Haymarket, W.C.

Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C.

Longmans, Green & Co., 39, Paternoster Row, E.C.

Whittaker & Co., 2, White Hart St., E.C.

TELEPHONES.

General Electric Co., Ltd., 67, Queen Victoria St., E.C.

Gent & Co., Ltd., Faraday Works, Leicester.

Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, S.E.

Siemens Bros. & Co., Ltd., Woolwich.

Western Electric Co., Ltd., North Woolwich, E.

WIRING CONTRACTORS. See page iv.

WOODWORK CASING AND CONDUITS.

Jennings & Co., Pennywell Rd., Bristol.

When corresponding with Advertisers, please mention "Electrical Engineering."

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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SUMMARY

DR. LEWIS JONES, the well-known specialist in electro-therapeutics, died on Sunday (p. 149).

WE publish some further letters from central station engineers regarding the restriction of electricity works extensions (p. 150).

THE conditions to be contended with in connection with telephony in the tropics were discussed at the last meeting of the Institution of Electrical Engineers, in connection with a paper by Mr. W. Ll. Preece (p. 151).

A NEW form of rectifier for obtaining high tension direct current consisting of a vacuum bulb with heated cathode has been developed in America (p. 152).

A SCHEME is on foot for the formation of an Engineer Volunteer Training Corps by the Institution of Electrical Engineers (p. 152).

MR. G. WILKINSON writes to correct a misapprehension which might arise from remarks in a contemporary regarding his contribution to Mr. Cooper's paper on electric cooking (p. 152).

A CORRESPONDENT suggests a scheme whereby skilled amateur craftsmen might be employed in making munitions of war (p. 152).

A NUMBER of technical books are reviewed (p. 153).

A PAPER on intercommunication telephones was read at the last meeting of the Association of Supervising Electricians (p. 154).

A FURTHER hitch has occurred in the negotiations for the purchase of the Bristol Tramways by the Corporation (p. 154).

THE running of a motor at very much reduced speed is discussed in our "Questions and Answers" columns (p. 155).

AMONG the subjects of specifications published by the Patent Office last Thursday are selective signalling, arc lamp suspension, oil circuit breakers and apparatus for enabling the blind to read (p. 156).

OUR Trade Section contains articles on electrical driving of paper-making machinery, electrically worked gates, and glassware for obtaining illumination approximating to daylight (p. 157).

AN expenditure of £164,373 is contemplated at Sheffield mainly to deal with Government work; a loan of £6,400 has finally been sanctioned at Heywood; cable is required in New Zealand and Australia; the West Ham Council is utilising £16,863 from reserve for extensions, and a loan of £18,000 is contemplated by the Barking Council (p. 158).

THE increase in charges for electric lighting in London has been questioned in the L.C.C.—Increased charges for electric supply, owing mainly to higher cost of coal, are notified in a number of provincial towns.—The Manchester Corporation is persisting in its endeavours to obtain sanction to the loan for the Barton power scheme (p. 158).

For arrangements for the week, see page vii.

OBITUARY

HENRY LEWIS JONES.

DR. H. LEWIS JONES, the authority on medical applications of electricity, died at his house in Harley Street on Sunday after a long illness. He was fifty-eight years of age. Dr. Lewis Jones was in charge of the electrical department at St. Bartholomew's Hospital from 1891 to 1912, and on his resignation was appointed a Governor of the Hospital and Consulting Medical Officer to the Electrical Department. He was elected to a Fellowship of the Royal College of Physicians in 1894. In 1900 he read a Paper on "The Applications of Electricity in Medical and Surgical Practice" before the Institution of Electrical Engineers, and he acted as official delegate for the British Government at the International Conference of Physical Therapeutics at Liège in 1905 and in Paris in 1910. Dr. Lewis Jones's book on "Medical Electricity," which has run through many editions, is the standard work on the subject. His death is a great loss to the profession.

Electrical Labour Troubles.—Although the underground railway companies in London came into line with the other companies and granted the war bonus of three shillings per week, the engineers and mechanics have declined to accept it. They ask that the increase shall be permanent in view of the increase granted in London in November by the Engineering Employers' Federation. April 10th has been fixed as the date for striking.

The electrical employees of the Port of London Authority also threaten to strike on April 14th unless they are granted one shilling per hour and a 48-hour week.

THE RESTRICTIONS ON ELECTRICITY WORKS EXTENSIONS

WITH reference to our articles on this subject (*ELECTRICAL ENGINEERING*, March 11th and 25th and April 1st), we now publish extracts from some further letters which we have received from central station engineers:—

Hampstead.—Mr. W. Wyld writes: Fortunately for us we had a few months ago obtained the L.C.C.'s sanction to the borrowing of £17,300, so that we are not at the moment affected. Owing, however, to the present tightness of the money market, we are having to pay very heavy interest on the loans. I quite agree that with things in their present condition of reduced outputs and approximately 50 per cent. increase in the price of fuel, and the prospect of 1-watt lamps in small sizes at an early date, every care should be taken to build up the reserve fund rather than allocate profit to the relief of the rates. Where satisfactory reserve funds have been built up, it would certainly be advantageous to use these at the present time for necessary extensions.

Plymouth.—Mr. E. G. Okell writes: I do not anticipate that the refusal of the L.G.B. to grant loans for extensions will seriously affect the Electricity Department of the Old Plymouth area at the present time. It has been the practice for some years past to pay for all low-tension mains extensions, for services, electricity meters, &c., out of net revenue, also sundry high-tension extensions have been carried out under the reserve fund; no capital has been borrowed for these purposes for some years.

Ipswich.—Mr. Frank Ayton writes: As we have just completed a comparatively large extension, including the installation of three-phase plant, and a four-wire three-phase distribution for the Eastern District of the town, it is improbable that we shall be launching out on any further extension work for many months. I quite agree that for any future extension work it is desirable to utilise one's reserve fund, but, unfortunately, ours is not of a large amount, although we have so far made a firm stand against any allocation of profits of the Electric Supply Department to the relief of rates. In my opinion, the Treasury restrictions upon capital expenditure by local authorities must necessarily have a serious effect upon the progress of the electric supply undertakings in general, although the effect will not be immediately felt. At the same time, I do not think that anyone should complain, as the main aim at the present time should be a victorious termination of the war for ourselves and our Allies.

Coventry.—As mentioned in our last issue (p. 136), a loan of £46,932 for extensions was sanctioned quite recently. Sanction was given without the holding of the usual L.G.B. inquiry; the bulk of the electricity is to be used by firms engaged on Government contracts. Mr. George Tough writes us that he is quite in agreement with our suggestion as to the utilisation of reserve funds. The Coventry accounts for last year show that, in addition to amounts written off for obsolete and superseded plant (now totalling £29,365), there had been, up to date, a further amount of £22,488 transferred to the capital account for the purchase of new plant, and this was increased by a sum of £13,250 out of last year's profit, and spent on house services, sub-station equipment, cooling towers, and street mains for the future.

Wolverhampton.—Mr. S. T. Allen writes: I think that this is an occasion for utilising reserve funds as far as possible for extension work if it can be clearly realised that those reserve funds should be again built up as soon as possible out of the profits of the undertaking. With regard to the allocation of profits to rate relief, I certainly think that now is an opportune time for some definite statement on the part of the Local Government Board on the matter. The Local Government Board Inspectors have from time to time been very definite in their remarks relating to the allocation of profits, and in several cases have condemned, as far as they were able, the practice of allocating so-called profits to rate relief before adequate reserve or depreciation funds have been built up. The condition of things with regard to labour and cost of material on account of the war have shown us all the great wisdom of building up adequate reserve funds, and I feel that some definite pronouncement on the part of the Government would be welcomed by many Councillors who have to meet ratepayers in November, and who could, with thankfulness, wash their hands of what must be to many an uncomfortable task, that is the promise to press for rate relief from trading undertakings which have no full reserve or depreciation funds built up. I think the precedent has already been established by the Government departments in connection with Provisional Orders such as that of the Potteries Amalgamation a few years ago, when it was stipulated, I believe, that the prices should be so regulated that after full allowance had been made for expense, depreciation, and reserve no net profit should be made. The benefits of such an Order, if it could be made general, would be enormous, both to the undertakings and to the ratepayers. So far as the Wolverhampton Undertaking is concerned, the reserve fund amounts to approxi-

mately 50 per cent. of the amount permitted by statute, and has not suffered so much by transfers to the relief of rates from profits as other undertakings. Further, it is the practice to meet expenditure of a capital nature, such as services, meters, &c., out of reserve fund. Notwithstanding this, yearly amounts of £1,147 to £2,125 have been so transferred during the past eight years.

Basingstoke.—Mr. George Broadhurst writes: As this undertaking has only been running for six months, we have, of course, no reserve fund. We are at the present moment requesting the sanction of the L.G.B. for a loan, but as this is to supply a firm which is engaged on war supplies, we hope there will be no difficulty.

West Ham.—Mr. J. W. Beauchamp writes:—I quite agree with you that a good opportunity is presented for utilising reserve funds where they exist, and in spending revenue surplus on permanent works. Beyond that I do not think that the action of the Local Government Board need be taken too seriously. In most supply undertakings there is a large amount of business to be obtained along the routes of existing mains, therefore canvassing, instead of being general can now be made special, and directed to securing business where that can be done with a minimum of capital expenditure. The question of the employment of joiners and men connected with mains extension is hardly a serious one, as there is a brisk demand for that class of labour, and electricity departments would probably already have lost many such employees but for the fact that the latter prefer to keep a permanent job if possible. I do not anticipate that the Electricity Department in West Ham will be appreciably affected by the restrictions proposed, as new power business obtainable in the district is generally of such a character that a good case can be shown for borrowing for it if necessary.

Harrogate.—Mr. G. Wilkinson informs us that he has been refused sanction for a loan for service cables and transformers, and is recommending his Committee to set aside a sum out of this year's profits (which are double the estimated amount) for them.

Stoke-on-Trent.—Mr. Chas. H. Yeaman informs us that when the electrical undertakings in the present Borough were combined exactly a year ago, Hanley came in with about £2,200 reserve fund, but the three D.C. undertakings came in with an aggregate loss of about £4,400, so that there is no reserve fund available. Some extensions in prospect before the war are not to be proceeded with.

Derby.—Mr. T. P. Wilmshurst writes:—I consider that in this crisis we have no option but to submit to the wishes of the Treasury. Fortunately we have recently completed large extensions of our plant, and intend to connect up any new consumers to our existing distributors, charging the cost to revenue account. The normal growth of business must of necessity be checked and mains construction staffs must in some cases be dispensed with temporarily. There is, however, a great demand for labour of all kinds, and through the agency of the local Labour Exchange we have just sent off a party of pick and shovel labourers to Salisbury Plain to make roads, &c. I may add that the terms offered are very attractive. Where motors are required for hire purposes and the Supply Authority has not the necessary reserve fund, arrangements might be made temporarily for the makers to hire the motors to the Supply Authority, who could purchase outright at the termination of the war. I am opposed, at this and any other time, to using surplus profits for the relief of the rates while money is at the same time being borrowed for the carrying on of the undertaking.

Westinghouse Smoking Concert.—About thirty members of the Headquarters Supply Department staff sat down to supper at the Exchange Hotel, Manchester, on Monday of last week. Afterwards there was an excellent smoking concert, at which Mr. J. Gibson (Manager of the Supply Department) presided, fifty members of the Supply Staff and a few specially invited guests being present. During the evening the Chairman referred to the continued prosperity of the Supply Department, the turnover of which in twelve months had increased about 30 per cent. He missed several old faces in the gathering, particularly that of his Chief Assistant, Mr. G. Ellam, who had been away many months in Russia. During the evening the following toasts were enthusiastically honoured:—"The King," proposed by Mr. J. Gibson; "His Majesty's Forces," by Mr. L. E. Wilson; "The Westinghouse Co.," by Mr. W. S. Robson, the latter being responded to by Mr. W. J. Hollick; "Our Visitors," by Mr. A. Pouger, responded to by Mr. L. E. Wilson; "Our Chairman," by Mr. H. H. Bent, responded to by Mr. J. Gibson. The following artists rendered yeoman service in entertaining the company:—Messrs. A. Pouger and T. Jackson as pianists, Mr. A. Pouger (hautist), Mr. T. E. Kenyon (humourist), Mr. T. Clough (elocutionist), Mr. O. C. Oakley (baritone), Mr. W. S. Robson (violinist), Mr. McColl (humourist), Mr. F. Freeman (elocutionist), Mr. D. E. Elliott (Newcastle dialect recitation), while the "Inharmonious Four" caused great merriment by their vocal efforts.

TELEPHONE TROUBLES IN THE TROPICS

M R. W. LL. PREECE read a paper on this subject before the Institution of Electrical Engineers on Thursday, March 25th, and laid particular stress on the variations necessary before applying ordinary home practice to telephone systems in tropical regions.

Taking the case of instruments first, he said that teak prevented the ravages of white ants, but there were other insect troubles. An instrument was shown which some bee-like insects in Nigeria had made a hive of, entering through the slot for the switchhook, and actually forming a comb inside and reforming it several times after it had been completed. Spiders' nests in telephone cases were also not uncommon. As a preventative the switch-hook should carry a brass plate to keep the slot entirely covered. It is also desirable to have no terminals above the instrument, but to take the conductors through holes, which are subsequently sealed up. The internal wiring should be made as simple as possible, and not bunched but well stapled to the body of the instrument in separate ways. In subscribers' instruments (although not always in exchange instruments) enamel insulation with a silk covering is suitable. Some ebonite receiver sheaths in the West Indies had softened from the heat, and of course this is remedied by using blocked brass sheaths covered with enamel. In another tropical country, the insulating block carrying the contact springs in a capsule transmitter, became so warped by the damp heat that both springs short-circuited on the metal case. Faults in subscribers' instruments due to lightning are few, and may be avoided by fixing the protector at the point where the wires enter the house. In cases where the protectors had been fixed near the instrument, buildings had been frequently set on fire; several cases having occurred in the telegraph offices of Northern Nigeria. Many faults were also due to misuse of the instrument by the subscriber himself, and one case was mentioned where the mouthpiece of a hand set had been habitually used as a cigarette ash-tray.

The choice of the exchange switchboard system, Mr. Preece considered, must be largely affected by the difficulty of maintaining satisfactory insulation on overhead lines in the tropics, owing to the moist heat, so that the pressure of 24 or 40 volts required for the central battery system was to be deprecated unless underground mains were possible. At Port of Spain, Trinidad, a central battery system had been found unsatisfactory, and the more distant subscribers had had to be connected to a separate magneto board. On the other hand, in Havana, Cuba, he understood that an automatic system was giving satisfaction, but he had not personally inspected it. On the whole, therefore, he was entirely in favour of a magneto system either with mechanically restored indicators, or incandescent lamps controlled by relays. Trouble had, however, been experienced with enamelled wire windings on the relays owing to the damp atmosphere acting on the copper if there was the slightest defect in the enamel. Certain mechanically restored indicators, especially the eye-ball type, had given trouble, the steel pins on which the eye-balls were mounted were apt to rust, and, in fact, Mr. Preece regarded it as essential that any iron or steel must be galvanised or otherwise coated.

There is also trouble, he said, in obtaining suitable operators in the tropics, the climate usually renders it impossible to employ Europeans, and lack of ability, early marriage, or form of religion, makes native operators unsuitable. Sixty to eighty lines per position are all that can be handled as a rule, so the telephone department long for a simple automatic system. Mr. Preece then described a simple magneto board with lamp indicators and automatic clearing, which was now used in the Malay States.

There are also many line troubles peculiar to the tropics. In some parts it is not unusual to have a mile or two of lines wrecked by giraffes, elephants, or monkeys. The giraffes roaming over the wilds of East Africa, come against a telegraph or telephone line, and instead of drawing back or ducking their heads, they push on and sometimes carry the wires and poles with them. In the best practice the poles are either of wrought iron with taper tubes and cast-iron bases, or of the Hamilton type, built up of tubes of riveted sheet steel. In most places the white ants render wooden poles impossible, on the other hand wooden arms can be used, as the ants will not work their way up the iron tube to reach them. Where hard wood is not obtainable, tubular iron arms are employed, carrying six, eight, or twelve Cordeaux porcelain insulators on iron stalks. The insulation of all lines is very low, however, as the atmosphere has frequently a humidity of 80 to 90 per cent. But the most troublesome factor is the vegetation, as it is often difficult to induce the Government to clear away the trees. The normal clearing of the roads is supposed to be 60 ft., but is not always maintained, and even with 60 ft. clearing the lines must be within 20 ft. of the trees at the best, and are often less than 10 ft. away. Unless a further 50 ft. clearance is maintained contacts and breakages due to falling trees are almost a daily occurrence. Underground lines cannot be used when sometimes the subscribers are 20 to 25 miles from the exchange. Mr. Lawson, the chief engineer in Southern Nigeria, was able to persuade

his Government that 100 ft. clearance through the forest was essential, and the result is most satisfactory.

In Java the wires are suspended on span wires attached to poles on either side or to trees, and this has been found satisfactory, although Mr. Preece suggests that there is some danger to the public. Insects on the insulators cause frequent troubles; some insects delight in making their homes between the petticoats of insulators, and Mr. Preece had seen an insulator which was covered with a spider's nest so as to be invisible. Spiders' webs formed in a single night between the wire and the insulator stalks will reduce the resistance of a line to a few ohms. The ordinary oil insulator was found useless, as the oil chamber became entirely blocked up with insects. Mr. Guthrie Spain, telegraph engineer at British Guiana, was the first to call the author's attention to the fact that insects will not enter glass insulators, and these are said to be effective in Cuba. The reason is apparently that the insects prefer a dark place for their home. The author suggests that if oil insulators of glass could be easily obtained, considerable improvement would result. Ordinary carbon block lightning protectors give trouble, practically after every storm, owing to carbon dust being carried across the gap and placing the two carbon blocks in contact. This can be avoided by using the vacuum type of protector. The author also referred to a suggestion made by Mr. J. Sayers of the Midland Railway, to protect a line from lightning by erecting an earthed line along the tops of the poles. In underground work, Mr. Preece thinks that the practice hitherto followed of making the joints so that dry air can be periodically pumped through, is unsuitable for the tropics. He says that once the damp has entered the cable, no amount of pumping will drive it out completely, and the length has to be replaced. The tapped plugged holes as air inlets for the pumping are also, he says, possible inlets for damp. He suggests that solid joints should be made, as in America, and that the cable should be well sealed with paraffin wax immediately it is open for jointing. In Shanghai there is a curious flying insect which is able to bore holes in which to lay its eggs in the lead covering of overhead cables, but the author knows of no case in a tropical country where an insect has damaged an armoured lead-covered cable.

In the concluding part of his Paper, Mr. Preece referred to the staff difficulties. It is too expensive to obtain inspectors, foremen and linesmen from England, as no white man can live in the tropics comfortably on less than £250 a year. This means, therefore, the employment of native labour for the lower grades of the technical staff, and it is difficult to find natives with sufficient conception of responsibility or with any power of command.

Thirteen speakers took part in the discussion, ten being telephone engineers and the remainder manufacturers. Sir John Gavey, who spoke first, gave an idea of the conditions met with in South America, where no trouble had been experienced with the staff. He did not approve of the filling of joints, but most of the other speakers did. Mr. W. W. Cook, Mr. W. Slingo (Chief Engineer to the G.P.O.), and Mr. H. Laws Webb pointed out that without details as to the size of the area or the population to be served, it was difficult to discuss the relative merits of the local battery, central battery, and automatic systems, but there was general condemnation of Mr. Preece's preference for the local battery system, Mr. Slingo suggesting that it implied that telephone engineers had made no progress as regards telephone installations in the tropics since 1867. Similarly there was a general feeling that a telephone engineer should not be too pessimistic upon the native labour question. Mr. Webb said that it had even been found possible to employ Mahomedan girls as operators in Constantinople.

The question of enamelled wires received some attention, and Mr. Slingo gave interesting particulars of the tests applied by the G.P.O. The wire must withstand an E.M.F. of 1,000 volts after having been immersed in the following solutions for forty-eight hours, viz., caustic soda, sulphuric acid, nitric acid, and hydrochloric acid, and finally in potash for thirty-five minutes. Opinions, however, were somewhat divided as to the suitability of these wires, trouble being experienced in obtaining a perfectly even layer of enamel in manufacture. The Post Office has also experimented with glass insulators, and several specimens were shown, made in France and Germany respectively, but the manufacture of insulators similar to the German ones is now being undertaken in this country. It has a basis of asbestos, and is claimed to be unbreakable either by stones or bullets.

As to the automatic exchanges, one has been erected at Simla and has proved efficient and satisfactory. Mr. Preece's doubts as to the Havana automatic exchange elicited from Mr. H. H. Harrison that there had been a phenomenal growth in the number of telephone subscribers there since the introduction of the system, and that every satisfaction is being given in spite of a troublesome climate.

Mr. R. W. Weightman and Mr. G. McAlpine called attention to the varying conditions in the tropics, so that one class of apparatus was hardly likely to be generally applicable. In the high lands the conditions were extremely dry, whilst on the coast quite the opposite obtained, lines, insulators, poles, &c., often being covered with damp salt. Mr. McAlpine, who has

had experience in Ceylon, has found iron wires impossible, and that 400-lb. copper wire is essential. Copper-clad steel wire has been found to last less than three months. The average life of a telephone instrument in Ceylon has been found to be not more than five years.

Other telephone engineers who spoke were Messrs. A. J. Stubbs, E. O. Walker, H. H. Harrison and R. Scruby. It was stated that instruments for use in the tropics require more attention than they usually receive. Mr. Scruby advocated metal casings, and called attention to the need for rounding all corners. The use of teak was generally agreed with, and also overhead cables, where possible, in preference to open wires. For poles, disused railway rails were recommended as both cheap and thoroughly suitable.

On behalf of the manufacturers, Mr. J. E. Kingsbury (Western Electric Co.), Mr. G. H. Nash (Western Electric Co.), and Mr. E. A. Laidlaw (Siemens Bros. & Co.) complained that the manufacturer was given little help by the engineer in the tropics as to what was needed. They usually were told that the apparatus would not work, and that was all, and at present, it was said, no two engineers in the tropics held the same opinions as to what was necessary.

The author, who did not attempt to reply in detail, said he had had in mind, in writing the Paper, real tropical countries such as Ceylon, India, Malay States, and Uganda. Many of the troubles referred to did not occur in the high lands, such as Nairobi. As to his preference for the magneto system, regard must be had to the size of the installations. Many were hardly deserving the name of exchange. The largest he knew was of 1,500 subscribers. There were two or three for 600, and others for 300, 100, and even 50 subscribers.

THE KENOTRON

A CONSIDERABLE amount of research has been concluded at the Research Laboratory of the American General Electric Co. on the properties of the hot cathode vacuum tube, an example of which is the Fleming oscillation valve depending on what was originally called the Edison effect. It had long been known that an exhausted tube containing two electrodes are heated by an external source acted as a rectifier, and the work of Dr. I. Langmuir, described in the *General Electric Journal*, was directed to removing the difficulties in the way of applying it practically as a high-voltage rectifier. The laws governing the quantitative action were fully investigated, and a number of forms of the apparatus, which has been named the "Kenotron," were experimented. For current-carrying capacities up to 0·5 amperes, either a cylindrical anode with a filament down its axis or a W-shaped filament between two parallel plates were found suitable. Another form, with an anode in the form of a molybdenum cap, was used with success up to 0·1 ampere and up to 15,000 volts, but for higher voltages up to 100,000 the cylindrical anode proved the best. The actual energy losses in the kenotron may be reduced to less than 2 per cent. of the total energy rectified when the tube is operated to its full voltage limit. Up to the present, kenotrons have been constructed for direct-current voltages as high as 100,000; but there is every expectation of being able to extend the field of application to 150,000 and even 200,000 volts. The maximum current rectified has been as much as 1,500 milliamperes (1·5 amperes); but it is much more convenient to construct these rectifiers in the form of 10-kw. units where the voltages required exceed 25,000. For lower voltages, smaller units are advisable. A great advantage possessed by the kenotron over the mercury vapour rectifier is that two or more units can be worked in parallel. It is considered that in the physical laboratory where small direct currents of a few milli-amperes at very high voltages are required, as for spectroscopic work, operating small discharge tubes, &c., the kenotron ought to prove exceptionally useful, as well as to produce high-voltage direct current for X-ray tubes and the precipitation of dust, smoke, &c. It is said to work satisfactorily at 100,000 cycles as at ordinary frequencies.

Benevolent Fund of the Institution of Electrical Engineers.—A special appeal is being made by Sir John Snell to elicit practical sympathy in the Benevolent Fund of the Institution of Electrical Engineers, which has been doing much good work during the last twenty-five years, but is still smaller than it should be, considering the size of the Institution. Indeed, it will surprise many to learn that the 7,000 members last year contributed no more than £87 in subscriptions and £180 in donations, and that the income from invested capital is only £175 per annum. These amounts are sadly inadequate to relieve the distress which exists within the field of operation of the Fund.

ENGINEER VOLUNTEER TRAINING CORPS

THE Institution of Electrical Engineers has issued a circular letter to members residing in the London district announcing a scheme for the formation of an Engineer Volunteer Training Corps, including members of the engineering profession who are either above military age, or who, being of military age, are prevented by some good reason from serving in the Regular or Territorial Forces. This scheme was suggested to the President, Sir John Snell, by General Sir O'Moore Creagh, V.C. (Military Adviser to the Central Association Volunteer Training Corps). The objects of the Corps, which would be affiliated to the Central Association according to the War Office conditions, would be to train men of military age to make them useful Royal Engineers recruits if and when they are able to enlist, and to furnish engineer units to assist in the completion of the volunteer organisation.

It is particularly desirable that the technical knowledge of such a Corps should be organised so as to be available at the earliest possible moment, and the units would be so constituted as to ensure that the maximum advantage would be taken of the specialised skill of their members. Instruction and training would be given in military engineering with special reference to field and fortress work (including telegraphs, telephones, searchlights, &c.), in addition to drill, musketry, and other military operations proper to an engineer unit. Drills would be arranged so that each unit would receive instruction for at least two hours per week in the evenings and on Saturday afternoons or Sundays.

Members joining will be required to provide their own uniforms and probably some part of the equipment.

ELECTRIC COOKING

IN view of some remarks of our contemporary, the *Journal of Gas Lighting*, relating to Mr. George Wilkinson's contribution to the discussion on Mr. Cooper's Institution Paper on "Electric Cooking," in which that journal implies that the electric water-heating installation to which he referred was not of sufficient capacity to ensure the cleanliness of an ordinary family, Mr. Wilkinson writes as follows:—"What I actually said was that the electrical heater has a cubical capacity equal to 12 gallons, but it is equal to an output of over 60 gallons of water per day at 100° F., which, I think you will agree, is a fair supply for a small household; it is found sufficient for two or three baths per day in addition to the ordinary kitchen requirements. I have facilities for the production of ten times this amount of hot water if necessary, but the output of the electric heater is found ample for ordinary everyday demands."

CORRESPONDENCE

SKILLED LABOUR FOR THE MAKING OF MUNITIONS OF WAR.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In view of the expressed opinions of the Leaders of the Government as to the difficulties of manufacturing munitions of war and the acknowledged shortage of labour, the Society of Model and Experimental Engineers desires to call attention to the existence in this country of the considerable amount of mechanical ability and experience possessed by people who are not professionally occupied in engineering. No doubt many of these would be willing to offer themselves for service in Government workshops if suitable conditions of employment can be arranged. As the easiest means of effecting this the Society would suggest that the Government should give its consideration to the formation of an Industrial Branch of the Royal Engineers, in which such men might enlist without having to conform to the existing military standards.

The Society is of opinion that there are a number of capable men who would willingly come forward under a scheme of this kind, as they would then feel they were part of the recognised force employed in the defence of the country. Such a proposal as this, if carried into effect, would probably also attract trained workers whose services are not at present being utilised for Government work.

I am, Sir, yours obediently,

HERBERT G. RIDDELL,
Secretary, Society of Model and Experimental Engineers.

37 Minard Road, Hither Green, S.E.,
March 31st, 1915.

REVIEWS OF BOOKS

Consumers' Accounts and Meter Department Routine. By A. G. Glover. 49 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. (London : Electrical Press, Ltd.) 5s. net; abroad, 5s. 3d.

This work is intended as a guide for those in charge of the commercial and financial departments of supply undertakings, and comprises some nineteen model forms, commencing from the receipt of the consumer's application form. While presumably designed to cover all sizes of undertakings, small concerns with a limited clerical staff will find it somewhat difficult to find the necessary time for keeping up all the forms, and for these the models might be simplified. For instance, Forms 2, 3, 4, 5, 6, and 7 all contain identical details of the number, type, size, and pressure of the meter, and similar duplications occur elsewhere which could be avoided by a simple cross reference. There is no sample shown of the "Meter Test Book," and the "Meter Fix Register" (see Form 7) might contain the date and result of the last test of the meter, as this information is useful in cases of dispute with a consumer. Form 13, Meter Readers' Report, is somewhat obscure, as a meter reader's duty usually ends with reading the meter, and does not extend to reporting on the condition of the meter. Though not specifically mentioned, the author apparently has a preference for the looseleaf ledger rather than the card system; in Form 3 there are some advantages in the meter-reading sheets being in the form of cards containing only blank clock faces, as the chances of error on the part of the reader are somewhat less. A sample of each would be an advantage. The book concludes with extracts from the Electric Lighting Acts bearing on meters and accounts. The author evidently draws from a large experience, and the book can be thoroughly recommended for those who are commencing or reorganising their commercial departments.

Electric Cooking, Heating, Cleaning, &c. By Maud Lancaster. Edited by E. W. Lancaster. 335 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. 320 figures. (Constable & Co., Ltd.) 3s. 6d. net; abroad, 4s. 1d.

A comprehensive book on the domestic uses of electricity has long been wanted, and many will welcome the present attempt to deal with the subject from the consumers' point of view. Although, of course, much of its contents necessarily partake of the nature of special pleading, and the style of writing, in parts, is that of the advertisement rather than the text-book, it is quite the most complete work of its kind, especially as regards electric cooking, that we have seen. The writer evidently possesses the authority of experience. After a slightly disjointed introduction, opening with unnecessary remarks on amber and loadstone, the subject of cooking is gone into thoroughly and the requirements studied. It is then shown how these are met by electric cooking better than in any other way, and a large variety of apparatus is illustrated and described in a manner that ought to be a great help to those choosing appliances for cooking on a large or small scale. The information is quite sufficiently technical, and an interesting feature is a collection of heating time curves for different designs of ovens. Costs and quantities are gone into for the requirements of a small family, and there is also a section on hotel cooking equipment. Other subjects treated in a similar way, but not quite at the same length, are water heating, heating of rooms, fans and ventilation, medical and other personal applications, vacuum cleaning, ironing, &c. The actual equipment of an "electric home" is described, a short glossary of technical terms is given, and a useful concluding table gives the prices charged for current for heating in different places.

Electric Mine Signalling Installations. By O. W. Lummis. Paterson. 196 pp. 7 $\frac{1}{2}$ in. by 5 in. 189 figures. (London : Constable & Co., Ltd.) 2s. 6d. net; by post, 2s. 9d.

In view of recent developments, the subject of mine signalling has become one both of increased complexity and importance, and many will welcome a book dealing with such matters. The author goes into a considerable amount of detail, especially in his description of bells, keys, indicators, batteries, wiring, &c., and the arrangement of shaft and haulage signals, and our principal criticism is that he has allowed the fulness of the elementary part to interfere to a slight extent with the development of the later portion where we should have liked to see a little fuller treatment of such subjects as new systems of indicating signal gear of the nature now required by the Home Office regulations, and a little more on the much-discussed question of danger from

sparking from signal installations, where gas may be present. There is much, however, that is eminently practical and should be of use to those engaged in the fitting-up of signal installations in mines.

Magnetism and Electricity. By S. S. Richardson. 598 pp. 7 $\frac{1}{2}$ ins. by 5 ins. 260 figures. (London : Blackie & Son, Ltd.) New Edition. 4s. 6d.; abroad, 5s.

The author in this work, of which the second edition is now before us, addresses himself to students of physics rather than budding electrical engineers. He assumes some acquaintance with the "elementary descriptive parts of the subject and introduces the reader to more quantitative ideas. The work is divided into three parts: on magnetism, static electricity, and current electricity respectively, and some idea of the range of the book may be gathered from the fact that the principles of the dynamo and motor are contained in a short chapter near the end, followed by one on electrical units, and one on terrestrial magnetism and atmosphere electricity. The present edition is designed partly with a view to satisfying the requirements of certain Board of Education and University Examinations.

Alternating-current Electricity and its Applications to Industry. First Course. By W. H. Timbie and H. H. Higbie. 534 pp. 7 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. 389 figures. (New York : John Wiley & Sons; London : Chapman & Hall, Ltd.) 8s. 6d. net; abroad, 9s. 2d.

The authors provide in this work a first course of instruction in alternating currents of a thoroughly practical nature, following their subject through clearly and logically, and stimulating the interest of the student throughout by illustrations from problems of practical engineering. Thus a considerable amount of space is given to armature windings of alternators, but this is not, as the authors explain, with the object of teaching how to wind an armature, but to help in giving a clear understanding of the real meaning of phase difference, vector summation, and polyphase relations. A large number of problems to be solved by the student are given, which add to the utility of the book.

A Manual of the High-Speed Steam Engine. By H. K. Pratt. 270 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{2}$ in. 182 figures. (London : Constable & Co., Ltd.) 5s. net; abroad, 5s. 6d.

The development of the high-speed steam engine is indissolubly bound up with the history of electric lighting plant, and is a branch of steam engineering well meriting a treatise to itself. The author is, we believe, the first to supply this want, and in doing so he has produced a sound and practical manual dealing with the history, design, testing, and operation of these engines, including clear and useful drawings of complete typical engines, as well as details. The book deals primarily with the double-acting, forced-lubrication type of engine, but the single-acting engine is also considered. The high-speed engine has by no means been totally eclipsed by the turbine, even though the days of its largest sizes may be numbered, and engineers will continue to value the results of experience embodied in this work for some time to come.

Dynamo and Motor Building. By A. H. Avery. 152 pp. 7 in. by 5 in. 145 figures. (London : Cassell & Co., Ltd.) 1s. net; by post, 1s. 1 $\frac{1}{2}$ d.

This is a thoroughly practical book for the amateur, and is clearly written and well illustrated, containing a great deal of useful information for those desirous of constructing small dynamos, motors, converters, both as regards electrical details and mechanical methods. The machines described are not toys, but properly designed apparatus, which, if the instructions are followed, will also be properly constructed.

Dynamometers. By Rev. F. J. Jervis-Smith, edited and amplified by C. V. Boys. 267 pp. 9 in. by 5 $\frac{1}{2}$ in., 119 figures. (London : Constable & Co., Ltd.) 14s. net; abroad, 14s. 8d.

Prof. Boys, to whom the task fell to complete and prepare for publication this work of the late Rev. F. J. Jervis-Smith, has prefaced it with a charming little biographical note of the author, who is well known as having been the pioneer of engineering education at Oxford, and had devoted close attention for many years to problems in the measurement of power. The book deals with dynamometry with great thoroughness, giving us an interesting historical sketch of experimental progress, setting forth such theoretical considerations as are required with clearness, and describing the construction and working of practically every apparatus that has been devised for the measurement of mechanical power, including appliances for the laboratory, the test bed, the steamship, and the elaborate instruments that form part of marine testing tank equipments, and the whirling tables used for aeronautical research.

The Electrical Conductivity and Ionisation Constants of Organic Compounds. By H. Scudder. 580 pp. 9 $\frac{1}{2}$ in. by 6 $\frac{1}{4}$ in. (London: Constable & Co., Ltd.) 12s. 6d. net; abroad 13s. 4d.

This is a valuable work of reference to the organic chemist and physicist, and contains tables of organic substances, with their chemical formulae, specific conductivities, ionisation constants, conductivities of aqueous solutions and insolvents other than water, and other quantitative data. The list contains references to a bibliographical index of researches into the properties of each substance. There is also a formula index and a subject index, and the whole painstaking compilation forms a most complete compendium of recent organic chemical research.

Papers set in the Qualifying Examination for the Mechanical Sciences Tripos, 1906-1913. 90 pp. 7 $\frac{1}{2}$ in. by 5 in. 46 figures. (Cambridge: The University Press.) 2s. net.; by post, 2s. 2d.

THIS is a collection of questions set at Cambridge in what may be described as an intermediate examination in engineering. Mathematics and mechanics only are dealt with. The work will be useful to students as indicating the range of these papers.

American Handbook for Electrical Engineers. Edited by H. Pender. 2033 pp. 7 $\frac{1}{2}$ in. by 4 $\frac{1}{4}$ in. 891 figures. (New York: John Wiley & Sons; London: Chapman & Hall, Ltd.) 21s. net; abroad, 21s. 10d.

The bulky "pocket-book" of nearly 2,000 pages has been compiled by a staff of twenty-seven specialists, and although primarily addressed to the electrical engineer, a certain proportion of civil and mechanical engineering matter required by him is included; and again it should be of use to the civil engineer whose work occasionally takes him into electric fields. The practical information, which rightly forms the largest portion, is kept more or less separate from the theoretical discussions in each section. A somewhat different procedure is adopted from that in most of the existing works of this kind in that no subject-matter sequence has been attempted, but the articles are arranged alphabetically as in an encyclopaedia. It must be understood that American practice is principally referred to. For example, the only rules given in full are the new Standardisation Rules of the American Institute of Electrical Engineers. English readers will also find the use of the B. & S. wire gauge, the circular mil, and the ton of 2,000 lb. a little inconvenient, but on account of its completeness and up-to-dateness the work should be well appreciated here as well as in its own country. Telephony and wireless telegraphy are dealt with as well as the heavier branches of engineering, and a useful feature is a short bibliography at the end of each section.

The Universal Electrical Directory (J. A. Berly's), 1915. 1,554 pp. 9 $\frac{1}{2}$ in. by 6 $\frac{1}{4}$ in. (London: H. Alabaster, Gatehouse & Co.) 21s. British and Colonial Sections only, 12s.

THE 1915 edition of this directory, published by our contemporary, the *Electrical Review*, has been issued. As usual the contents are divided into four sections, viz., British, Colonial and General, Continental, and U.S.A., and the entries total some 35,390 names. The publishers have not been seriously affected by the war in the revision of the entries in the Continental section, as a good many corrections were received before the war started. The usual full information regarding electricity undertakings in the United Kingdom, British Colonies, and some other countries is given. We need hardly add that the new edition of this directory is thoroughly welcome.

Pitman's Shorthand Writers' Phrase Book and Guide: Civil Engineering. 88 pp. 6 $\frac{1}{2}$ in. by 4 $\frac{1}{4}$ in. (London: Sir Isaac Pitman & Sons, Ltd.) 1s. 6d. net; by post, 1s. 8d.

THIS is one of a series of books intended as a guide to shorthand typists for various professions. In addition to a list of words and phrases in common use in engineering offices, with their shorthand equivalents, there are specimens of specifications and correspondence, together with a general outline of the routine work in a municipal or consulting engineers' office. To a beginner just entering such an office there is a good deal of useful information contained in the volume.

The Batti-Wallahs.—An informal meeting was held on Wednesday of last week at the Victoria Mansions Restaurant, under the chairmanship of Mr. W. Wyld (Borough Electrical Engineer, Hampstead). An excellent entertainment was provided. The March number of the *Batti-Wallahs' Journal* records recent proceedings of the Society and includes a series of portraits of the officers and committee, with a brief note on the career of the new president, Mr. Haydn T. Harrison.

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TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A discussion on "Inter-communication Telephones" took place at a meeting of the Association of Supervising Electricians on March 30th, opened by a Paper by Mr. T. F. Lee, of the Western Electric Co. Considerable discussion centred round the question as to whether the cables should be connected directly to the terminals of the sets, or (as recommended by Mr. Lee) through junction-boxes. In either case the author recommended the use of a "forming board," consisting of a piece of board with nails protruding at the same distance apart as the connectors in the set or junction-box, round which the wires are bent and then bound with waxed string. This keeps the wiring always neat. Some speakers preferred to have the bells within the instrument cases to avoid their being put out of adjustment when the instruments were dusted, a trouble which is more frequently present with some types of "circular" bells.

Telephone communication between divers and the surface has long been an accomplished fact in this country, but none the less the demonstration at the Empire Theatre on Wednesday of last week by Capt. L. Sorcho of an American diver's telephone was of interest. A member of the Press was sent down in a diving dress fitted with transmitter and receivers within the helmet into a glass-fronted tank, and carried on conversations not only with those assembled to witness the demonstration, but with the office of his journal.

ELECTRIC TRACTION NOTES

The directors of the Bristol Tramways Co. have declined to continue the negotiations with the Corporation as to the sale of the Company's undertaking. The Corporation had appointed an Option Committee, one of whose duties was to ascertain the concessions the Company would make in the event of the Corporation not exercising its right of purchase and agreeing to an extension of the Company's life. The next step in the matter, therefore, is left solely with the Corporation. The Company's case is that a sale at the present time would result in considerable benefit to the shareholders, and the breaking off of negotiations is said to be due to the failure of the Corporation to reciprocate the Company's endeavours to avoid, in present circumstances, the large expenditure of public money which will be necessary if the purchase actually takes place.

A novel form of electric vehicle is in use in the Panama-Pacific Exhibition in the shape of a two-seated miniature car with basketwork body, capable of a speed of three miles per hour, to take the place of the wheeled chairs which have been a feature of many exhibitions. The "Electriquette," as it is called, is illustrated in the Canadian *Electrical News*, and has battery power sufficient for eight hours' running.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

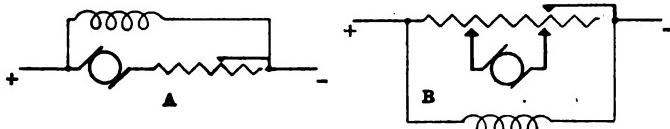
QUESTION No. 1437.

Acceptance tests of generators at works are often made by taking only copper and iron losses. Are these a reliable criterion of the operation of the machines at full load, particularly with regard to sparking?—"T. G."

(Answers must be received not later than first post Thursday, April 15th.)

ANSWERS TO No. 1435.

I wish to drive a milling cutter taking $\frac{1}{2}$ h.p. at 30 revs. per min. by means of temporary D.C. 15-h.p. motor which normally runs at 750 revs. Is it possible to reduce the speed of the motor to 30 revs., and will the speed remain fairly constant when the cutter is working, if a resistance is used in series with the



armature (with full excitation) to reduce the speed? I do not want to use reducing-gear. Are there any other ways of reducing the speed without altering the motor internally? Would it be better to shunt the armature across a resistance as in diagram "B" instead of series connection as in "A" to give constant speed?—"E. W."

The first award (10s.) is given to "ALPHA" for the following reply:—

It is possible to reduce the speed of the motor mentioned to 30 r.p.m. by means of series resistance, but the efficiency of working will, of course, be very low, and the speed of the motor will vary greatly with the load. The torque corresponding to 15 h.p. at 750 r.p.m. is 1,260 lb.-ins., and that corresponding to $\frac{1}{2}$ h.p. at 30 r.p.m. is 1,050 lb.-ins.; since the torque of the motor is proportional to armature current \times flux and the flux will be unchanged, it is evident that the motor will take $\frac{1050}{1260} = \frac{83}{100}$ per cent. of its normal full load current. The ventilation will be very much reduced owing to the armature having practically no fanning action at this low speed, and it is probable that the motor will overheat if the duty is of a practically continuous nature, unless it is designed as a totally enclosed machine. Assuming, however, that this difficulty does not arise, the speed characteristic and the efficiency will probably make the method of drive proposed impracticable, as shown below. A much better solution of the problem would be to arrange a temporary belt and countershaft, or gear drive.

(A) Plain series connection as shown in diagram A of the inquiry. Let V =supply voltage. Then, assuming that the C.R. drop in the motor at full load is 6 per cent., the back E.M.F. of the motor at 15 h.p. 750 r.p.m. will be $0.94V$ and at 30 r.p.m. it will be $\frac{30}{750} \times 0.94V = 0.0376V$. The C.R. drop at $\frac{1}{2}$ h.p. 30 r.p.m. will be $0.05V$, so that the total motor terminal voltage

will be $0.0876V$ and the series resistance must absorb the remainder of the supply voltage, or say $0.91V$. When the motor is running light, however, the current will be very much less. Assuming that it is 10 per cent. of the full load current, we find that the resistance will then only absorb 10 per cent. of $0.91V = 0.091V$, so that the voltage on the motor terminals will now be $0.909V$, and allowing for the motor C.R. drop the back E.M.F. must be approximately $0.9V$. Since the speed with constant flux is proportional to the back E.M.F. the speed of the motor running light with the resistance in series will be $750 \times \frac{0.9V}{0.94V} = 720$ r.p.m. In other words, the speed of the cutter before it commences its stroke will be twenty-four times the normal cutting speed (30 r.p.m.), and it is evident that either the cutter or the work would be seriously damaged by attempting to work under these conditions. With regard to efficiency, if C =full load current, it is evident that the power delivered to the motor terminals at full load is $0.0376VC$, and assuming the motor efficiency to be 85 per cent., the useful output of the motor will be $0.0745VC$, while the energy taken from the line = VC , i.e., the overall efficiency is only about $7\frac{1}{2}$ per cent.

(B) With the resistance connected partly in series and partly in shunt, as in diagram B, the speed characteristic will be improved, but the efficiency will be lowered still further. We have seen above that the voltage across the motor when giving $\frac{1}{2}$ h.p. at 30 r.p.m. will be $0.0876V$. This is also the voltage across the shunt resistance, so that if r is the shunt resistance in ohms, the current in this resistance will be $0.0876V/r$ and the current in the series resistance will be $C + 0.0876V/r$. We have also shown that the voltage across the series resistance must be $0.91V$, so that if R is the series resistance we have:—

$$R = \frac{0.91V}{C + 0.0876V/r}$$

From this, by assuming values of r we can find corresponding values of R . It can also be shown that the no load speed of the motor will be (approximately) $\frac{750r}{r+R}$ and the overall efficiency at full load will be $\frac{0.0745Cr}{Cr + 0.0876V}$. It will be found that if r be chosen so that the no load speed is four times the full load speed (120 r.p.m.), the overall efficiency at full load will only be approximately 37 per cent., while further reducing the no load speed will rapidly increase the losses in the resistances.

The second award (5s.) is made to F. G., who writes as follows:—

The speed of a shunt motor can be reduced only by increasing the field strength or decreasing the voltage. Nothing can be done with the field in this case, as it is already working at full strength, and the only ways of reducing the armature voltage by resistance methods are the two suggested in the question, which will be considered in turn, and to give point to the answer let us assume that the motor is $500V$ with a no load speed of 800 r.p.m. and an armature resistance of 0.6 ohms.

(A) *Field fully excited and the armature connected to line through a series resistance.* This resistance can be arranged to reduce the speed to 30 r.p.m. with $\frac{1}{2}$ h.p. output, and the speed will be constant with constant load; that is to say, with the same cutter working on the same material with the same depth of cut and rate of feed. When, however, a variation in these factors reduces the load the motor will race to an extent which can best be realised by calculating the no load speed:—

Current at 15 h.p. 750 r.p.m. = 25 amps.

Current at $\frac{1}{2}$ h.p. 30 r.p.m. = $\frac{1}{2} \times \frac{750}{15} = 25$ amps.

Armature drop at 21 amps. = $21 \times 0.6 = 12.6V$.

Back E.M.F. at 30 r.p.m. = $\frac{30}{800} \times 500 = 18.75V$.

∴ Armature voltage at 21 amps. 30 r.p.m. = $31.3V$.

Drop of voltage in series resistance must be $500 - 31.3 = 468.7V$.

∴ Series resistance = $\frac{468.7}{21} = 22.3$ ohms.

Assume motor would take 5 amps. at light load.

Voltage drop in series resistance with 5 amps. = $5 \times 22.3 = 111V$.

Voltage drop in armature with 5 amps. = $0.6 \times 5 = 3V$.

∴ Back E.M.F. = $500 - 114 = 386V$.

Motor speed light = $\frac{386}{500} \times 800 = 618$ r.p.m.

As this speed is evidently quite impossible, a simple series armature resistance will not serve.

(B) *Field fully excited with shunting resistance across armature and a series resistance between the armature and line.*

In other words, this means a potentiometer resistance across the line with the armature spanning a suitable section of it. If this resistance is designed to pass a sufficient number of times full load current, it is evident that the connection of the motor will have practically no effect on the current, so that the voltage between the tapping points may be regarded as the same on all loads. Let us assume this to be the case and that the voltage on the armature is as at full load in the previous case, that is $31.3V$. Now what is the light load speed?

The armature resistance drop will now be $5 \times 0.6 = 3V$.
 Back E.M.F. = $31.3 - 3 = 28.3V$.
 \therefore Light load speed = $\frac{28.3}{500} \times 800 = 45$ r.p.m.

While this 50 per cent. increase between full and no load can scarcely be called "fairly constant speed," it may perhaps serve the purpose.

It should be added that to obtain approximately this best possible result the potentiometer resistance should pass at least say six times full load current. That is to say it should have a maximum value of 4 ohms and a capacity of at least 130 amps.

for the assumed voltage. Such a resistance would cost more than a reducing gear, and with power at one penny per unit it would cost about 5s. per hour to operate, the only asset on the credit side being that no starter would be required.

Among other replies we may mention the suggestion of "M. M." that an automatic speed regulator consisting of a liquid rheostat controlled by a governor be contrived, and that of "Koil," who proposes running the armature circuit from a few large storage cells.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 1st, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

• 28,277/13. **Selective Signal Reception.** W. H. SHEPARD and A. E. McKECHNIE. A line or wireless telegraph system with a selective device actuated only by a predetermined signal. In this device, a number of suitably spaced contacts are provided, and a number of brushes move relatively to the contacts, and are automatically displaced by the reception of the message to the one side or the other, according as dots or dashes are received. (Five figures.)

5,662/14. **Arc Lamp Suspension.** G. A. HUGHES. A system of arc lamp suspension in which the lamp is suspended from an inner pivoted frame swinging out to clear the lamp for lowering, and a single locking device locks the lamp when raised against vertical displacement, makes the connection between the lamp and the leads and locks the tilting frame. (Two figures.)

6,070/14. **Oil Circuit Breakers.** F. B. HOLT. Oil switches with a special form of moving contact giving a particularly quick break, which prevents the formation of bubbles of oil vapour. A row of inclined brushes is used of a form which reduces the displacement of oil to a minimum. (Two figures.)

10,368/14. **Apparatus for Enabling the Blind to Read.** E. E. FOURNIER D'ALBE. A row of moving dots of light are projected on to the letter to be distinguished by the movement of a perforated disc, and an image of the discontinuously illuminated letter is projected by a lens on to a light sensitive surface of selenium or other material in series with a telephone receiver. Different letters result in different sounds in the telephone, which the inventor states can be distinguished after sufficient practice. (Two figures.)

16,318/14. **Oil Circuit Breakers.** J. N. MAHONEY. Main and auxiliary moving contacts are provided, and reactance coils surround the fixed contacts. The main and auxiliary contacts are actuated by separate mechanisms, so that the auxiliary contacts close before the main contacts and open after them, so that the reactance is put in circuit before the final opening or closing. (Six figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: READ [Generating and control systems] 6,918/14; HOLDWAY and ANDERSON [Connectors] 13,960/14; TEGGIN and LONDON ELECTRIC WIRE CO. & SMITH'S, LTD. [Insulation] 19,878/14.

Heating and Cooking: W. T. HENLEY'S TELEGRAPH WORKS CO. and SAVAGE [Electrically-heated vulcanising apparatus] 13,348/14.

Instruments and Meters: BERRY [Indicating interruption or variation of current] 6,421/14.

Switchgear, Fuses and Fittings: CHERROU and LEMP [Switches] 8,010/14; SMITH [Circuit breaker] 18,747/14.

Telephony and Telegraphy: AUTOMATIC TELEPHONE MANUFACTURING CO. (Automatic Electric Co.) [Telephone systems] 6,428/14; MARTIN [Telephone systems] 6,659/14; GREEN [Telephone switches] 7,513/14; HAZARD [Telephone index or directory holder] 11,229/14; WESTERN ELECTRIC CO. (Woodward for W. E. Co., U.S.A.) [Telephone exchange systems] 13,523/14.

Traction: COLLINS [Signalling] 6,179/14; BOUND and ROWLAND [Train stops] 6,807/14.

Miscellaneous: CRAIG [Electric clocks] 6,970/14; MELLERSH-JACKSON (Posen) [Pocket lamps] 18,809/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: SCHÖNGUT [Armature winding] 3,932/15.

Instruments: LANDIS & GYR A.G. [Current measurement] 3,856/15.

Switchgear, &c.: ANDERSON [Switches] 3,657/15; VAN SWAAY and ANR. [Synchronisers] 3,676/15.

Telephony and Telegraphy: DE FOREST and ANR. [Wireless receiving system] 3,950/15; SÄRNMARK [Wireless telegraphy and telephony] 4,017/15.

Miscellaneous: FORD [Gyrostatic compasses] 10,095 and 24,847/14; LILIENFELD [Production of Roentgen rays] 4,097/15.

Amendments made

16,409/04. **Meters.** B.T.-H. CO. Amendments have been allowed in this specification, which is for induction motor meters, by which one of the claims is omitted and other omissions are made on account of the doubtful novelty of a portion of the subject-matter.

17,487/14. **"Wired" Wireless Telegraphy.** G. O. SQUIER. At the request of Dr. ERSKINE MURRAY, patentee of No. 15,718/11, an acknowledgment has been introduced into this specification of the lack of novelty of the use of a 0.01 microfarad condenser in the high frequency bridge, which enables ordinary telephone lines to be used for "wireless" reception.

Opposition to Grant of Patents

1,341/14. **Combined Starting Motor and Lighting Dynamo.** A. H. MIDGLEY and C. A. VANDERVELL. Opposition has been entered to this specification, which describes a machine with separate commutators and armature windings for use in its two functions and the field windings, which as a self-regulating dynamo leave half the poles unexcited, are re-grouped to give the full number of poles when working as a motor.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: C. E. G. GILBERT [Arc lamp] 27,303/08.

DYNAMOS, MOTORS and TRANSFORMERS: B.T.-H. CO. (G.E. CO., U.S.A.) [Single phase motors] 27,894/03; A.E.G. [Prevention of sparking of A.C. motors] 26,094/05; B.T.-H. (G.E. CO., U.S.A.) [Single phase motors] 27,849/07; H. A. MAVOR and MAVOR & COULSON [Induction motor with rotatable "stator"] 28,040/07.

Electrochemistry and Electrometallurgy: C. BINGHAM [Electric furnaces] 28,593/06; T. A. SMITH and T. DEAKIN [Electro-plating] 27,624/08.

Heating and Cooking: S. L. R. PRICE [Electric heating] 29,411/09.

Ignition: SOC. ANON. MONBARBON [Magneton] 24,737/08.

Storage Batteries: G. LUCKOW [Regenerating battery plates] 29,706/09.

Switchgear, Fuses and Fittings: G. SWEETSER [Thermal flasher] 27,213/08.

Telephony and Telegraphy: GES. FÜR DRAHTLOSE TELEGRAPHIE [Wireless telephony] 26,530/07.

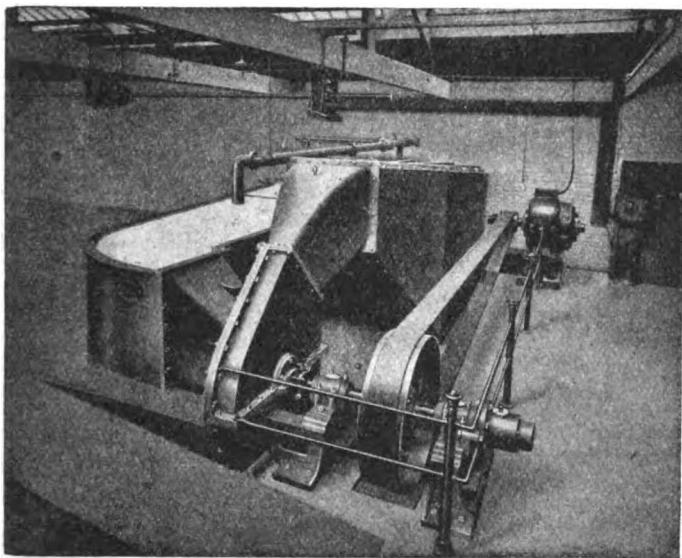
Traction: T. A. HEARSON (Bleichert) [Electric ropeways] 27,733 and 27,734/03.

Miscellaneous: OTIS ELEVATOR CO. (Otis Elevator Co., U.S.A.) [A.C. lift control] 27,352/04; W. FAIRWEATHER (C. H. Huff, U.S.A.) [Electrostatic separators] 27,449/04; SIEMENS BROTHERS DYN. WKS., LTD. and C. S. GRIMSTON [Duplex searchlights] 28,004/07; H. SKELTON [Ozoniser] 27,107/08; ELECTRIC EXPORT GES. and E. GOTTSCHALK [Miners' lamps] 29,789/09.

"ELECTRICAL ENGINEERING" TRADE SECTION

ELECTRIC DRIVE FOR PAPER MAKING MACHINERY

AN example of the electric drive as applied to paper-making machinery is given in the accompanying illustration, which shows a 45-h.p. "Witton" motor supplied with power at 230 volts, running at 420 r.p.m., and driving a special kind of breaking and bleaching engine. The function of this machine is to break or disintegrate the sheets of wood



ELECTRICALLY-DRIVEN PULP BREAKING PLANT.

pulp by means of a special impeller and circulate the pulp to the bleaching engine in a concentrated form. The motor is controlled by a "Witton" controller and a main switch with ammeter, seen on the extreme right of the illustration. The electrical equipment was supplied by the General Electric Co., Ltd., of Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.

ARTIFICIAL DAYLIGHT

IN response to a number of inquiries for glassware which will ensure artificial light of daylight value, the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), are putting on the market a most complete range of colour-matching screens and globes. The name "Trutint" has been given to the glassware employed, and it is available in several grades.

In one variety the composition of the glass is such as to ensure the most accurate matching in colour comparison work, but is not intended for general room lighting. Another coloured glass is for general illumination, and gives a light of "noon" sunlight value, and is particularly suitable for general lighting in paint shops, lithographic plants, art galleries, &c. The "noon" sunlight globe is made of clear Trutint glass sandblasted inside, and ensures a light corresponding to noon sunlight. The watts per candle efficiency of Mazda half-watt lamps when fitted with this particular type of globe is practically equivalent to standard Mazda lamps in a white opal globe. A variety is also supplied for general illumination, and ensures a light of "afternoon" sunlight value. The purpose of the Trutint globes in this case is to furnish a light that is slightly more efficient in watts per candle than in the last mentioned, and necessarily somewhat yellower, as is the case with afternoon sunlight, forming a compromise between colour and efficiency. The globes in this group are made of Trutint glass cased over by a light opal, or a very light opal body in which Trutint has been mixed, and are known respectively as "Trutint Cased" and "Trutint Opal." The cased glass appears white when unlighted, while the other units appear bluish. When possible, complete installations of Trutint glass should be ob-

tained, so that the yellow light of other lamps be not present. Trutint glassware is not made for use with ordinary Mazda lamps, but has been specially compounded for Mazda half-watt lamps, which, owing to their high intrinsic brilliancy, are more like sunlight in colour than previous incandescent lamps.

ELECTRICALLY WORKED GATES

ASOMEWHAT novel application of electric driving is for the remote control of the opening and closing of gates. The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), have called our attention to an installation of this kind in the North of England, where a pair of handsome iron gates at the entrance to a drive are worked by a $\frac{1}{2}$ -h.p. "Witton" motor geared through a clutch to a mechanism for opening and closing the gates. The motor and mechanism are housed in a small tunnel underneath the gates, a small manhole situated to one side giving access. Power is supplied from the house installation, and the controlling switch is placed in the garage. This controlling switch is of the reversing type, so that putting the switch in one position closes the gates, and putting it in another position opens them. In completing the circuit the motor is started up and a solenoid circuit energised, thereby connecting the motor to the gate-opening mechanism through the clutch. The presence of this clutch, which is open when the motor is not at work, enables the gates to be opened or closed by hand when desired. The gates were constructed by Messrs. Lockerbie & Wilkinson, Tipton, Staffs, and the operating mechanism by the Witton-Kramer Electric Tool & Hoist Co. (Witton, Birmingham), for whom the General Electric Co., Ltd., are sole selling agents.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Melbourne Electric Supply Committee requires 13 tons of bare hard-drawn copper cable and 13,560 yards of insulated copper cable. Tenders to Messrs. McIlwraith, McEacharn & Co., Biliter Square Buildings, E.C.

Barking.—The Council has decided to apply for a loan of £18,000 for electrical extensions.

Dundee.—Centrifugal circulating pumps and cast-iron piping. General Manager and Engineer. April 28th. (See an advertisement on another page.)

Glasgow.—Twelve months' supply of cables, meters, and arc lamp carbons. Chief Electrical Engineer. April 16th. (See an advertisement on another page.)

Heywood.—We referred at some length on page 102 of our issue for March 11th to the application of the Council for sanction to a loan of £12,480 for electrical extensions. This was the first application to come under review after the Treasury's announcement that all borrowings by municipal electricity undertakings must be curtailed to such an extent as is absolutely necessary to deal with power supplies for Government contracts. The amount asked for was £12,480, but the L.G.B. has now given its sanction to £6,400.

Sheffield.—A L.G.B. inquiry was held last week concerning a loan of £164,373 for electrical extensions. It was explained that this large sum is necessary, not for ordinary expansion of business, but in order to supply the large armament firms in the city. The amount is apportioned as follows:—New generating plant, £86,813; sub-stations and equipment, £50,000; buildings at Neepsend, £27,560. Among the applications now in hand is one for six new melting furnaces of 6,000-kw. capacity. It was also pointed out to the Inspector that one firm could not carry on at the speed required by the Government without an extra supply of power, and, further, the Government had given the Electricity Committee permission to prevent their men from recruiting, having regard to the desirability of turning out the largest possible number of units.

New Zealand.—The Public Service Stores Tender Board at Wellington requires 74½ miles of lead-covered cable. Further

particulars at 73 Basinghall Street, E.C. Tenders by April 21st. This information is only of value to firms who can advise agents by cable.

West Ham.—The Council has decided to withdraw £16,863 from the Loans Fund in order to purchase machinery. This sum will bear interest at the rate of 3½ per cent.

Wiring

London: Woolwich.—220 houses to be wired for the Woolwich Borough Council at Eltham.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bolton.—Factory for R. Walker, Ltd.

Darwen.—Extension to Moss Bridge Hospital.

Miscellaneous

Australia.—The Victorian Railway Commissioners require 120 single-phase track transformers; 300 electric train stops; bogie trucks, wheels, and axles for 10 cars. Further particulars at 73 Basinghall Street, E.C.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Burton-on-Trent.—The Electricity Department has placed a contract with E. Bennis & Co. for two stokers and self-cleaning compressed air furnaces.

Croydon.—The tender of Callender's Cable & Construction Co. for a twelve months' supply of cable on a sliding scale according to the market price of copper has been accepted.

Huddersfield.—An order has been placed with E. Bennis & Co. for 4 pairs of chain-grate stokers for Stirling boilers.

Iford.—A contract has been placed with the B.T.-H. Co. for a twelve months' supply of meters.

Salford.—The Tramways Department has placed the annual contract for Wotan, Tantulum, and carbon filament lamps with Siemens Bros. Dynamo Works.

Walthamstow.—The contract with J. H. Tucker & Co. for single and double pole 5 and 10 ampere tumbler switches has been renewed for a further twelve months.

LOCAL NOTES

Colne: *The Rateable Value System of Charging.*—Mr. A. G. Cooper, the Borough Electrical Engineer, has recommended an optional system of charging for electricity on a rateable basis with a secondary charge of 4d. per unit. The matter has been referred to a Sub-Committee.

Croydon: *Increased Charges.*—The flat rate for lighting is to be increased from 3½d. to 4d. per unit. A recommendation that the charge for public lighting should be increased in corresponding proportion to the increase made by the Gas Co. for gas lamps has been referred back.

Dublin: *Electricity Charges.*—The Corporation has decided to postpone giving a decision as to increasing the charges for lighting and power until the detailed estimates for 1915-16 are ready.

London: *Woolwich: Electricity Loans.*—Terms have been arranged with the L.C.C. for the borrowing of £48,000, which is the balance of expenditure to be incurred on the extensions to the electricity undertaking in accordance with the recommendation of Sir John Snell. This matter has been under discussion for some considerable time in connection with the loan periods. The L.C.C. first suggested that some of the older plant should be sold and the outstanding loans paid off immediately, but this view did not meet with the approval of the Borough Council. The total amount of out-

standing loans on a 42 and 39 years' basis for plant and machinery is £64,732, and the condition proposed to be attached to the new loan is that the amount outstanding on April 1st, 1920, of the £64,732 is to be repaid within one-half of the periods then unexpired. Subject to this condition, which the Borough Council has accepted, the sum of £35,000 has now been sanctioned, leaving the remaining £13,000 to be dealt with after a further report by Sir John Snell.

L.C.C.: Electric Lighting Charges.—The decision of the London electric supply companies to increase their charges, as notified on page 142 of our last issue, was raised at the meeting of the L.C.C. before the Easter recess. Mr. W. C. Johnson hinted that the companies were increasing their charges solely to maintain dividends. Mr. G. H. Hume, Chairman of the London Electricity Supply Committee, pointed out that the companies were still charging less than the maximum price mentioned in their Provisional Orders, and were apparently within their legal rights. He promised, however, to give consideration to a suggestion as to whether the present legislative conditions under which the companies work affords sufficient protection to the public.

Maidstone: *Increased Charges.*—The price of current is to be increased temporarily by ½d. per unit for lighting and 1½d. per unit for power, owing to the higher cost of coal.

Manchester: *The Barton Power Scheme.*—Reference has already been made to the representations made by the Corporation to the Treasury to grant an exception to the prohibition of capital expenditure upon new electricity works in the case of the Barton power scheme, having regard to its magnitude and the pressing needs of the city. The Central Executive Committee of the Employers' Parliamentary Association has passed a resolution urging the Government to sanction the scheme on the ground that to hold it back will hamper to a very considerable extent the firms engaged on Government contracts. According to the statements made by the L.G.B. Inspectors, however, there is no likelihood of consent being refused for the necessary machinery to keep such firms supplied with all the power they need. The point made by the Corporation itself is that the whole of the scheme should be allowed to go forward.

Stoke-on-Trent: *Large Power Supply.*—The Council has sanctioned the agreement with Messrs. Keeling & Walker for a large power supply in connection with a new chemical process previously worked in Prussia, referred to on page 100 of our issue for March 4th. The contract contains a coal clause.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £76 10s. to £77 (last week, £76 to £76 10s.).

Prices of Fittings.—The British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), inform us that a 10 per cent. advance has been made in their prices of electrical fittings.

Agency.—A firm in Wellington (N.Z.) desires to represent British manufacturers of lead-covered cable. Further particulars at 73 Basinghall Street, E.C.

Change of Address.—Mr. J. G. Lorrain, Consulting Engineer and Chartered Patent Agent, has removed to 9 John Street, Adelphi, W.C.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Companies Struck off Register.—The following have been struck off the register of joint stock companies:—Electrical Regulators & Economisers, Ltd.; Indestructible Accumulators, Ltd.; International Electric Transport & Enterprise Company of Alsace-Lorraine, Ltd.; Kellogg Manufacturing Co. (Europe), Ltd.; Leeds & Bradford District Electric Railways, Ltd.

Midland Electric Corporation for Power Distribution.—The full dividend is paid on the 6 per cent. preference shares for 1914, carrying forward £3,650, after writing off £9,083 for depreciation. This is an improvement on 1913, when only the debenture interest was met.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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SUMMARY

EXTENSIONS of plant, including two large turbo-alternators, boilers, switchgear, and rotary converters, have recently been put down at the Swansea Electricity Works (p. 160).

IN a Paper published by the Institution of Electrical Engineers, Mr. S. Evershed described an investigation into the resistance to motion of various types of meter counting trains (p. 160).

WE publish some particulars of the Constantinople telephone system. The English staff has been displaced by a Hungarian staff; they have been obliged to leave Constantinople, and when last heard from were across the Bulgarian frontier (p. 161).

A NOTE with regard to the terms used in connection with cables in the United States points out that those now accepted there differ to some extent from those employed in Great Britain (p. 161).

THE equipment of an electrically driven textile mill is described in an illustrated article (p. 162).

A PAPER by Mr. S. M. Hills, read at a meeting of the Junior Institution of Engineers on Monday, reviewed the subject of electric heating and cooking, and gave practical notes on modern apparatus for these purposes. (p. 163).

SEVERAL technical books are reviewed in this issue (p. 163).

MR. C. HAMILTON WICKES, H.M. Trade Commissioner in Canada, gave an address on Friday on the marketing of British goods abroad. He said that our present

trading methods with foreign countries are very little better than they were in the eighteenth and the early part of the nineteenth centuries (p. 164).

METHODS of determining whether a three-phase winding is star or mesh connected are discussed in our Questions and Answers Columns (p. 165).

SOME interesting details of the conditions under which field telegraph and telephone work are carried out at the front are given under "Telephony and Telegraphy" (p. 165).

AMONG the subjects of specifications published at the Patent Office last Thursday were tramcar brakes, telephony and insulating material. The grant of a patent for helical filament lamps of an application of C. O. Bastian has been refused. A patent for improvements in electro-pneumatic multiple unit train control expires this week, after a full life of 14 years (p. 166).

EXPENDITURE upon new plant is contemplated as follows:—Dover, generating set, £6,000; Leigh, £2,813; Middleton, mains, £3,000; Wigan, boilers, £6,000.—Cable, switchgear, transformers, and public lighting are required at Abercynon; rotary converters at Bexley; generating plant at Ballymena; arc lamp carbons at Melbourne; and electric cranes in Spain (p. 167).

A DIFFICULT position has arisen between the Belfast Electricity Committee and its Chief Electrical Engineer.—The question of reduction in street lighting charges through the war has arisen at Chichester.—The Board of Trade is stipulating that new electric lighting provisional orders must not be put into force before the end of the war (p. 168).

AN issue of £100,000 new capital is being made by the London Electric Supply Corporation (p. 168).

Arrangements for the Week.—(To-day) Thursday, April 15th.—Institution of Electrical Engineers, Victoria Embankment, E.C. "The Power Supply of the Central Mining-Rand Mines Group," by J. H. Rider. 8 p.m.

Friday, April 16th.—Institution of Mechanical Engineers, Storey's Gate, S.W. Presidential address by W. C. Unwin, F.R.S. 8 p.m.

Saturday, April 17th.—Association of Mining Electrical Engineers, University College, Nottingham. "Protective Devices against Lightning and Surges," by E. K. Scott and L. F. Fogarty. 4 p.m.

Birmingham and District Electric Club, Swan Hotel, New Street. "Telephones," by E. J. Jarrett. 7 p.m.

Monday, April 19th.—Institution of Post Office Electrical Engineers, I.E.E., Victoria Embankment, E.C. Annual General Meeting. 5 p.m.

Electrical Trades Benevolent Institution, I.E.E., Victoria Embankment, E.C. Annual General Meeting. 6.30 p.m.

Tuesday, April 20th.—Wireless Society of London, I.E.E., Victoria Embankment, E.C. "Methods of Measurement of the Strength of Wireless Signals," by Prof. E. W. Marchant. 8 p.m.

Wednesday, April 21st.—Association of Mining Electrical Engineers, West of Scotland Branch, Royal Technical College, Glasgow. "Bearings of Electrical Machinery," by A. Gibson. Also discussion on paper, "Some Experiences in the Handling of Electricity," by A. Smellie. 6.30 p.m.

EXTENSIONS OF PLANT AT SWANSEA

IMPORTANT extensions have been made in the plant at the generating station of the Swansea Electricity Department. The new plant includes two large turbo-alternators, with condensing plant, switchgear, &c., two rotary converters, and the necessary extensions in boiler plant.

The turbo-generators are of the horizontal Curtis type, made by the British Thomson-Houston Co., Ltd. (Rugby), and are designed to give 1,875 k.v.a. each when running at 3,000 r.p.m., and supplied with steam at a pressure of 150 lb. per sq. in., and a vacuum of 28 in. The generators give three-phase current at a pressure of 6,600 volts and 50 cycles. Each generating set is capable of giving 25 per cent. overload for two hours continuously and 50 per cent. overload for ten minutes, with steam at normal pressure and 85 per cent. vacuum. The turbines are provided with centrifugal governors capable of controlling the speed within 2 per cent. from no load to full load, and an emergency governor, positive in action, designed to shut off the steam should the turbine reach a speed of 15 per cent. above the normal. The governors are fitted with electric motors, connections from which are taken to the switchboard gallery so that the speed of the machines may be adjusted therefrom. Dry-air filters are provided; these are fixed outside the building and connected by means of air-ducts to the alternators. The condensing plant was made by Cole, Marchent & Morley (Bradford), and is of the surface type, with Edwards' pattern air-pumps. The air and circulating pumps are driven by a single motor. The condenser is designed to maintain a vacuum of 28 in. when condensing 27,000 lb. of steam per hour, with cooling water at a temperature of 65° F. and a 30-in. barometer.

The extra-high-tension switchgear was supplied by the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester), and is arranged for remote electrical control. The low-tension control switches and instruments are mounted on a bench-board of black enamelled slate. The E.H.T. switchgear is placed in cubicles built of moulded stone, and sheet-iron doors are provided for the oil-switch cubicle; the doors of the other E.H.T. chambers are of expanded metal. Red and green lamps, fixed on the control panels, show whether any particular oil switch is open or closed. The E.H.T. switchgear controls the two turbo-generators, two 500-kw. rotary converters, and four three-core 0·1 sq. in. outgoing feeders. Two D.C. rotary converter panels for 440-580 volts have also been supplied, arranged for lighting or traction.

There are two Westinghouse rotary converter sets at the generating station. Each converter has a capacity of 500 kw. at 750 r.p.m., and is of the six-phase eight-pole horizontally divided type, suitable for giving any D.C. voltage between 440 and 480 when operating as shunt machines or 500 volts at no load, and 560 volts at full load as compound machines. An A.C. booster is mounted on the rotary converter shaft, and a squirrel-cage induction motor for starting purposes is mounted at the other end of the shaft. One 550-k.v.a. 3/6-phase oil-insulated self-cooling transformer is provided, suitable for transforming from a 6,600-volt 50-period supply to a suitable secondary voltage. The boosters allow of complete and independent control of the power factor on the A.C. side and the voltage on the D.C. side. This, of course, is possible because the power factor control and the D.C. voltage control are obtained by adjusting the rotary and booster excitations respectively. By this means, therefore, the power factor on the A.C. side may be maintained at unity, or even leading, at any load or voltage on the D.C. side. Any lagging current taken by induction motors on the A.C. system can therefore be neutralised by the leading current of the rotary converter. The starting gear for these sets is quite simple. It consists of a starting panel upon which is mounted a three-pole low-tension switch in the main L.T., A.C. current, a smaller three-pole switch for the starting motor stator circuit, a double-pole rotary field switch, and a central zero D.C. voltmeter. For starting up, all these switches except the field switch are opened. The oil switch on the E.H.T. side of the rotary transformer is then closed. On now closing the starting motor stator switch, the L.T., A.C. circuit would be completed through the starting motor stator, and the motor would therefore start. The stator of the induction motor is wound for the same voltage as that on the secondary side of the transformer. Each of the three phases of the rotary converter are connected in series with the slip-rings; the primary circuit, therefore, is completed through the armature. At the first moment of starting the motor has practically full voltage across its windings, due

to the low impedance of the rotary armature. Owing to the high impedance of the starting motor windings, the current is reduced to about 30 per cent. of the normal full load current. When the D.C. voltage builds up, the voltmeter is watched and the field current is adjusted to give normal voltage. The starting motor is then short-circuited by closing the low-tension alternating switch, and then the motor starting switch opened.

The new plant in the boiler-house consists of two Stirling water-tube boilers fitted with superheaters and under-feed mechanical stokers. One boiler has a heating surface of 5,157 sq. ft. and a grate area of 91 sq. ft., and is capable of evaporating 26,000 lb. of water per hour from and at 212° F. The other boiler is slightly larger, having a heating surface of 5,719 sq. ft. and a grate area of 98 sq. ft., and is capable of evaporating 29,000 lb. of water per hour from and at 212° F. The superheaters were made by the Superheater Units, Ltd. (Swansea), and consist of four distinct units complete with cylindrical solid draw steel heaters, disposed one on each side of the central steel inlet and outlet junction piece containing solid diaphragm faced on each end, and provided with flanges for the attachment of the units, which are fitted with wrought steel flanges. The four units contain 88 tubes, giving a total heating surface of 580 sq. ft. The mechanical stokers were made by the Underfeed Stoker Co., Ltd., and are of the push plate type.

The Uplands is the only sub-station ready for running at present. The plant in this sub-station consists of two 500-kw. rotary converters, together with the necessary transformers and switchgear.

We are indebted for the above particulars to the kindness of Mr. J. W. Burr, Borough Electrical Engineer.

METER COUNTING TRAINS

A PAPER by Mr. S. Evershed, containing the results of a painstaking research into the effect of the variable resistance of motion offered by the registering trains of electric supply meters, is published in the *Journal of the Institution of Electrical Engineers*. The author arrives at the following conclusions:—

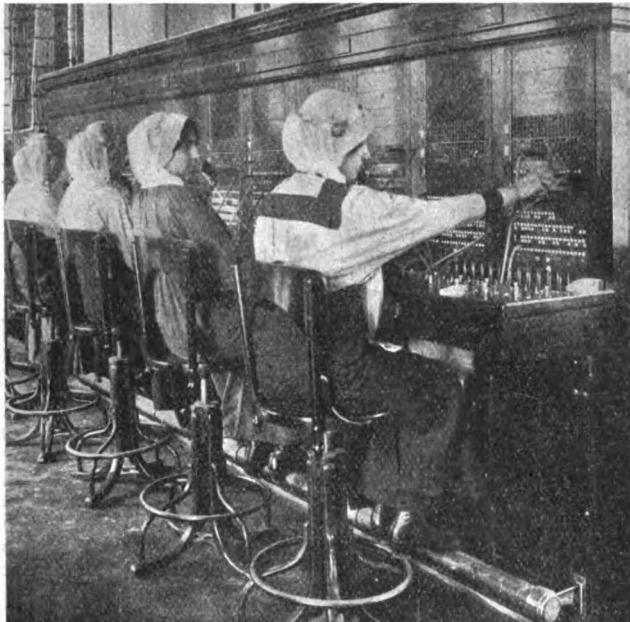
The only variations to be reckoned with in meters with pointer dials are the small irregular changes common to all meter trains, which at one-tenth load with a worm drive may amount to as much as 1·2 per cent. either way in the case of a meter which has a full-load torque as low as 1·grm. cm., and perhaps as much as 0·4 per cent. with a spur drive. They are quite haphazard in their occurrence, and in those instances in which low-load testing is affected by them nothing but a prolonged run will secure a fair average. When a meter has a creep counter dial of the Harding type the fall in speed at times when one or more nines are changing to zero is apt to lead to considerable discrepancies at a low load in the case of all meters which have a torque-speed product of less than 100 (grm. cm. × r.p.m.). The only way to avoid them is to carry out all low-load tests at times when the first digit wheel alone is in motion. Although the decrease in speed which results from the increase in resistance during the nine-changing periods may be very large, the resulting under-registration over a long period of use is unlikely to amount to as much as 1 per cent., and might well be allowed for in the initial adjustment of meters. With "jump" counter dials, provided the jump device is not fitted on an axle nearer to the rotor than the tenths axle in a 1-kilowatt meter, the units axle in a 10-kilowatt meter, or the tens axle in a 100-kilowatt meter, the periodic changes due to the rising and falling of the jumper weight and counter weight are comparatively small, but would certainly have to be reckoned with in low-load tests on meters which have a torque-speed of less than 50. With a jump counter which has both jumper and counter weights, the speed rises above and falls below the normal value twice in each revolution of the axle on which the jump device is fitted. If low-load tests are carried out at times when either of the digits 1, 4, 6, and 9 is passing by the centre of the dial opening, the meter should be running at the normal speed corresponding with the load. By carrying out a low-load test in this way, comparatively large periodic variations should not give rise to any difficulty.

The Kenotron.—The article on this device in our last issue was based on an article in the *General Electric Review* (published by the General Electric Co. of New York). By an error the name of our contemporary was given as the *General Electric Journal*.

THE CONSTANTINOPLE TELEPHONE SYSTEM

THE telephone system in Constantinople, which belongs to an English company, the Constantinople Telephone Co., Ltd., had been in successful operation for some little time before the declaration of war with Turkey on November 5th. Constructional work in connection with extensions was proceeding, and the European war had affected the Company very little except as regards the difficulties of getting material delivered. The situation is now very different, however, as will be seen later in this article.

In Constantinople three large telephone exchanges have been built, and a few sub-exchanges, and there are about 5,000 subscribers. The plant is of a most modern character, having been so recently erected; the common battery system is employed, and a feature is that there are practically no overhead wires, the majority of the wires being either underground or in cable on the face of buildings. In connection with junction wires also the most modern practice has been employed, "loaded" wires being used throughout, and no wire heavier than No. 20 S.W.G. The system extends to both sides of the Bosphorus, and reaches Prince's Island on the south and Kavak on the north. Altogether the Company employed about fifty Europeans on the staff, and, in addition, there were about twenty-five workmen on erection work



TURKISH OPERATORS IN CONSTANTINOPLE TELEPHONE EXCHANGE.

belonging to the British Insulated & Helsby Cables, Ltd., and about twelve belonging to the Western Electric Co., Ltd. The men of the two latter Companies, however, left after the declaration of war, as it was impossible to proceed with much of the new work on account of the non-delivery of material. A few of the Company's linesmen also returned when war was declared with Turkey, but the majority of the European staff remained. The work of the exchange went on just as before, and, in fact, new lines were connected up to some extent, so far as material there permitted. Naturally there were a few minor troubles, and the situation was a difficult one for the staff, but, taken as a whole, everything proceeded quite calmly until about three or four weeks ago. It may be mentioned that the Company has been accustomed to working under war conditions, for this is the fourth war in the Balkans since they started the erection of the exchanges.

Soon after the bombardment of the Dardanelles started, however, trouble began, probably owing to German influence, and, as stated in the daily papers last week, the authorities have seized the property of the Telephone Company, and, according to the *Daily Telegraph*, have inflicted great hardships on the British staff. They left Constantinople about three weeks ago and got as far as Kuleli Burgas, but after being detained there three days were sent back to Stamboul. They were allowed to leave Constantinople again a few days later, and finally arrived at Dedeagatch, the other side of the Bulgarian frontier, on Good Friday. Although no news has yet been heard directly from them, it is known that Mr. Douglas Watson, the General Manager, and twenty-four other men, arrived together at Dedeagatch, together with three ladies (probably including Miss Minter, the Traffic Manager).

Mr. Watson's staff included Mr. J. M. Anderson, the Accountant, and Mr. Andrew Duncan, the Chief Electrician. Mr. Podmore, the Chief Engineer, had come home before war was declared with Turkey, and obtained a commission over here in the R.E. According to the *Morning Post* last week, the Constantinople staff has been replaced by Hungarians, under the control of the Austrian Councillor, Eugen Redl.

The operators themselves included only a few English-women, who were engaged there in the ordinary course, and were not brought over specially. The majority are Jewesses, Armenians, and Greeks, and there are a few Turks, in spite of their being Mohammedans.

Our illustration shows a group of these Turkish operators in their distinctive head-dress, and was the subject of a slide which was shown by Mr. W. W. Cook at the discussion on Mr. W. Ll. Preece's paper a fortnight ago.

CABLE TERMINOLOGY

CARE must be taken to avoid confusion when corresponding with America with regard to cable and wires, as the terms employed there are to some extent different from those prevalent here. The American Bureau of Standards, working in conjunction with the American Institute of Electrical Engineers, has issued the second edition of a circular relating to "electric wire and cable terminology." The loose method of utilising the word strand either for the wires making up the cable or the cable itself is wisely discredited, and the terms "strand" and "stranded conductor" are adopted, each with its distinct meaning. "Cord" is the name given for "a small cable, very flexible and substantially insulated to withstand wear," but one of the two illustrations of this shows a 7-strand cable, which would certainly not be considered a "cord" in this country, and the other illustrates what is known here as circular braided flex., with two conductors. On the other hand, what is called flex., or twin flex., in England is given the name "twisted pair," as a "special case of a 'cord';" and twin wire is the name given only to two small insulated conductors laid parallel under a common covering. An ordinary single cable made up of strands in the ordinary way is called, rather misleadingly, a "concentric lay cable" (in distinction to a "rope-lay" cable, of which the main strands are themselves stranded). Instead of the accepted terms concentric and triple-concentric, the terms 2-conductor and 3-conductor concentric are laid down, and a 3-core cable is called a "triplex" cable. "Twin cable" is confined to flat twin cable (with the two conductors parallel and not twisted), while the more usual sort of twin cable is called a "duplex" cable.

A note at the end of the circular refers to the calculation of the resistance and mass of a stranded cable. The convention adopted in the United States is that the resistance and weight are both 2 per cent. greater than the resistance and weight of the same number of straight single conductors of the same length, but the definition is very badly worded in the circular.

Obituary.—The death took place on Wednesday last week of Major S. Flood-Page, at the age of eighty-two years. After leaving the Indian military service Major Flood-Page took over the management of the Crystal Palace, but resigned in 1882, and joined the staff of Edison's Indian & Colonial Electrical Co. In the following year he became secretary and manager of the Edison & Swan United Electric Light Co. More recently Major Flood-Page interested himself in wireless telegraphy, and was on the board of the Marconi Companies.

Mr. David Smith, Managing Director of the United River Plate Telephone Co., and Director of the Constantinople Telephone Co., died last Saturday.

A Combined Power Factor Corrector and Reserve Plant.—A somewhat unusual arrangement is adopted at one of the steam auxiliary generating stations of the Southern Power Company, of North Carolina, in connection with a large power transmission scheme taking power from five water power stations. The auxiliary station at Mount Holly, which is described in the *Electrical World*, contains one steam turbo-alternator of 8,000 k.v.a. generating at 44,000 volts and connected by step-up transformers to the 110,000-volt transmission lines. At times when the station is not called upon to give out power the alternator of this set is kept running as a synchronous motor to improve the power factor of the system. The boilers are kept with banked fires, and the turbine warmed up so that as the alternator is already in synchronism, it can be put on load when required immediately by admitting steam to the turbine and regulating the excitation. A small turbine-driven independent exciter is provided, as well as a motor generator, from which excitation can be taken.

AN ELECTRICALLY DRIVEN TEXTILE MILL

THE advantages accruing from the adoption of electric driving of textile machinery are being more and more widely taken advantage of, and it is now pretty generally realised that the case does not turn on power economy alone, but that the application of electricity to the driving of such mills brings with it benefits in the way of convenience, efficiency, flexibility, reduction in capital cost, quietness, safety, and cleanliness, in addition to the important gains in rapidity of production and quality of the goods produced.

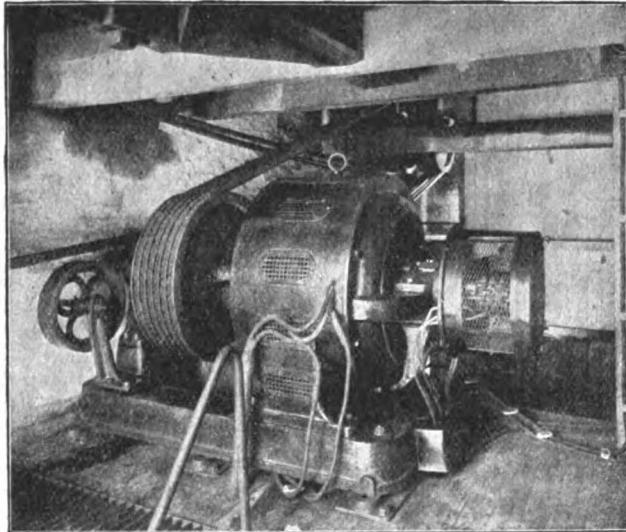


FIG. 1.—120-H.P. MOTOR DRIVING 6,000 SPINDLES.

An interesting example of electrical textile drive is found in the doubling frame installation equipped by the General Electric Co., Ltd. (Witton, Birmingham, and Victoria Bridge, Manchester), at the New Bridge Lane mills of Thos. Reynolds, Ltd., Stockport. In this installation the main "Witton" generator of 150-kw. capacity running at 385 r.p.m. delivers three-phase power at 500 volts, 25 cycles, and is driven direct through ropes from a main mill engine. On the same shaft is coupled a continuous-current generator, which supplies the excitation current for the alternator as well as continuous current for the lighting of the mill. The power from the

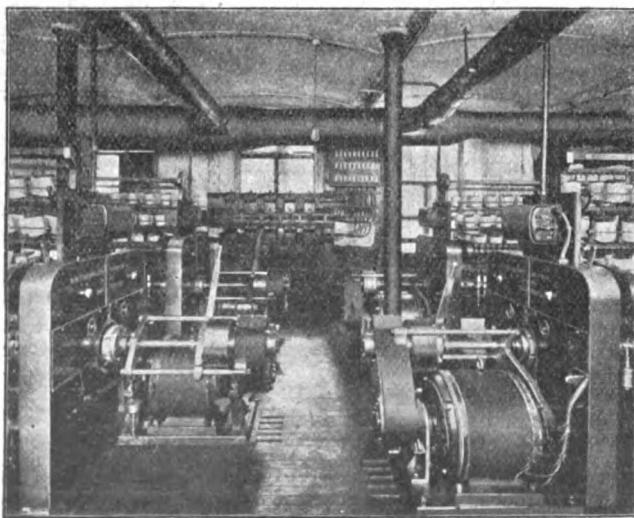


FIG. 2.—INDIVIDUAL MOTORS DRIVING DOUBLING FRAMES.

alternator passes through a main switchboard, where it is distributed to the electrically-driven portion of the mill. On one of these circuits is connected the 120-h.p. "Witton" three-phase slip-ring motor, shown in Fig. 1. This drives about 6,000 spindles from a central point, and runs at 490 r.p.m. It works in conjunction with two 45-h.p. water turbines. These turbines draw their water from the river Mersey, and an extremely ingenious arrangement has been adopted to overcome the variation in the water supply. The motor is of sufficient capacity to take the full load of the

6,000 spindles when the water supply fails. When there is a water supply available, the arrangement is such that the turbines take as much load as the water supply will permit and the motor develops the additional power. This is accomplished by means of a special clutch whereby when, through the scarcity of water, the speed of the turbines drops, they are instantly cut out and the motor takes the full load. As soon as the speed of the turbines comes up again, the clutch acts to effect engagement between the turbines and the motor, so that the load is shared as before.

From the main switchboard another circuit passes to distribute power in another part of the mill, wherein are installed ten doubling frames aggregating 4,000 spindles. These frames, which are illustrated in Fig. 2, are individually driven by three-phase squirrel-cage "Witton" motors taking power at 500 volts 25 cycles, and running at a speed of 1,490 r.p.m. Each motor is mounted on a bedplate complete with oil-immersed chain drive in a cast-iron case, which enables the tin roller shaft to be driven at the correct speed through a friction clutch and a flexible coupling. The drive is so arranged that by disconnecting the flexible coupling the whole gearing can be slung over approximately 45°, thus making the frame gearing accessible without in any way interfering with the motor or its gearing. The motors are run up to speed by star-delta starters of a simple compact design, which are conveniently situated in proximity to the motors. These starters are provided with mistake-proof devices which prevent the workmen inadvertently or inadvertently making a mistake in the starting-up operation, and fully protect the motor against damage. Main switches are placed in series with each motor. These are of the standard G.E.C. "Salford" pattern, complete with fuses.

This installation has solved for the owners a difficult problem, as the small headroom available would have made the installation of mechanical transmission very difficult. We understand that the owners are entirely satisfied with the application of electricity for driving their mill. We are indebted to Messrs. Thos. Reynolds, Ltd., for permission to reproduce the photographs of the installation and to publish this description.

London Power Supply.—On the suggestion of the Conference of Metropolitan Borough Councils owning electricity undertakings, the L.C.C. Special Committee on electricity supply is calling a conference for the purpose of discussing the most advantageous manner of dealing with the whole subject of electricity supply in London. It is possible that the companies will be invited to join. Incidentally, it may be mentioned that one or two counties outside London whose areas were included in the last L.C.C. Bill are making inquiries as to the possibility of promoting Power Bills themselves.

Dry Battery Manufacture in Germany.—A curious sidelight on the shortage of flour in Germany due to the war is thrown by information in German technical papers regarding substitutes that may be used for wheat or rye flour for thickening the electrolyte in dry batteries for pocket-lamps. For this purpose the following materials are recommended:—Glass-wool, sawdust, gelatine, starch, Kieselguhr, and water-glass. The following instructions are given for compounding the electrolyte:—140 grammes of well-powdered sal ammoniac, 40 grammes of zinc chloride, 10 grammes of ammonium sulphate are mixed together in a porcelain bowl with 10 grammes of thick refined glycerine. The mixture is then covered in small quantities with distilled water at a temperature of 40° C. and energetically stirred until the materials are dissolved into a concentrated solution. This mixture is allowed to soak into the binding material, and the paste so formed is filled into the cells, which are closed with a paraffined card top sealed with bottle-wax. In the cover two small glass tubes are provided for the escape of such gases as are generated within the cell. In compounding the electrolyte calcium acetate can be mixed with advantage with equal parts of the sal ammoniac. Such a solution possesses excellent conductivity, is hygroscopic, and does not crystallise or creep.

Magnetic Localisation of Shell Fragments.—At a recent meeting of the Académie des Sciences, Paris, a communication by M. J. Bergonité, describing a new method of localising shell fragments or other pieces of magnetic material in the human body, was communicated by M. d'Arsonval. A powerful alternating current electro-magnet is brought near the region affected, and the presence of a magnetic body within the flesh is indicated by a perceptible trembling of the surface at the immediate locality. By feeling the flesh the surgeon can easily find the spot where the trembling is strongest, and can thus locate the fragment of projectile with considerable accuracy. Experiments have been made with the apparatus in one of the French military hospitals.

ELECTRIC HEATING AND COOKING

A PAPER on "Electric Heating and Cooking Apparatus," by Mr. S. M. Hills, was read on Monday before the Junior Institution of Engineers. After some historical notes, the author explained the difference between radiators and convectors, and showed how, in some forms of electric fire, both methods of transmitting the heat were adopted as the convection air currents of heated air were given space to circulate through the back of the fire and round the glowing wire elements. In other cases convection is suppressed by limiting the access and egress of air, and nearly all the heat is emitted by direct radiation. Almost all non-lamp heater elements are wound with "nichrome" wire, and various methods of allowing for the expansion of the heated wire were employed in the design of the fire-clay or other support. It is of advantage to dispose the wires so that the fire-clay heats up gradually from one side, or there is a danger of the inner portions remaining soft and damp, and causing cracks by the imprisoned steam when in use. It is difficult to lay down a definite rule for the kilowatts required to heat a given room, but the following formula has been given by Mr. T. P. Wilmshurst :—

$$\text{Kilowatts required} = \frac{(30A + 8B + nC)20.4 \times t}{60 \times 60 \times 1,000}$$

where A =sq. ft. of window surface, B =sq. ft. of wall surface, C =cu. ft. of air in room, n =number of times air is changed per hour, and t =number of degrees F. air has to be raised in temperature.

The pleasant glow of the luminous radiator is popular among consumers, and a radiator gives a greater feeling of warmth than a convector of equal power, and heats up the surroundings in the lower part of a room more quickly than the latter, which sends its first instalment of heated air up to the top of the room. Tests have shown that electric heaters can heat up a room more rapidly than coal-fires, and have the advantage that, once heated, the energy given out can more easily be reduced to the value required to keep the room warm. Roughly speaking, 2 watts per cubic foot will heat a room up reasonably quickly, and half that amount is sufficient to maintain a comfortable temperature. The life of the heating elements varies from 2,500 to 4,000 hours.

With regard to cooking apparatus, the author generally preferred hot-plates of the enclosed or conduction type to the open or radiant pattern. Some curves, however, showed that the radiant hot-plate is more efficient for heating small quantities of water, but enclosed plates are better for larger quantities. The alloy of nickel and chromium known as "nichrome" is commonly used for the heating element, insulated with mica. Among points in the construction of hot-plates, the author mentioned the necessity for the top plate to be as thin as is consistent with freedom from buckling with rapid changes of temperature. The most usual source of trouble was in the connecting wires between the heating element and the terminal box. These should be of non-oxidisable material or the same material as the element, and at least three times the section of the element wire. The maximum loading possible is 25 watts per square inch, the limiting factor being the mica insulation, which will not stand a prolonged temperature above 700° F. The chief defect of hot-plates at present is that they are somewhat slow in boiling. The life of hot-plates is a variable quantity; some fail within a month, and others of the same make last a year or more.

The most satisfactory and popular part of the electric cooker is the radiant grill. A loading of 15 to 20 watts per sq. in. should be employed, and the element, which is usually assembled on fire-clay formers, should have as low a thermal storage capacity as possible.

In speaking of ovens, the author said that the unlagged bright oven had the advantages of cheapness and portability. It heated up quickly, but the lagged oven maintained its temperature with less expenditure of energy, and was, in his opinion, preferable for general purposes, although the largely-used bright oven had given much satisfaction. A loading of about 750 watts per cubic foot capacity was sufficient, and considerable range of regulation should be provided. A temperature of 350° F. should be attained in fifteen minutes. The elements could be placed at the bottom, sides, or top. The first arrangement, while giving good distribution of heat, was objectionable, as grease and water tended to collect on the element. It appears that among consumers in the north of England top and bottom heat is preferred, but side elements is favoured in the south. A good deal can be done with suitable deflectors to control the distribution of heat. Large elements with moderate loading per square inch are to be preferred. In the latest form of the "Tricity"

oven a ribbed hot-plate is used, which has a better radiating capacity, and gives better results than the older form.

The author favours the placing of the control switches on a control board away from the cooker itself, with fuses preferably of the cartridge type for every heating unit on the same board, together with indicating lamps for each circuit, and the leads to the cooker enclosed in flexible metallic tubing. A main double pole must also be provided. Several patterns of ironclad switch, fuse, and indicator box are now made on the unit principle, so that they can be assembled into control boards that can be added to at any time. It is, in the author's opinion, imperative that all cooking apparatus in the kitchen be effectively earthed, and particularly necessary that the earthing of no piece of auxiliary apparatus be omitted. There is now an increasing tendency towards the standardisation of all parts of the equipment, and this, in particular as regards the contacts of spare heating elements, will have a great influence on the success of electric cooking in the future. It should be as easy to change a heating element as a lamp.

Experience with a particular cooking installation for a household of four showed a daily average consumption of 1.47 units on the oven and 2.52 units on the hot-plate and grill. Figures given recently by Mr. R. Weaving before the Birmingham Electric Club were quoted showing that, comparing gas at 2s. 3d. per 1,000 cu. ft. with electricity at ½d. per unit, the ovens were favourable to electricity, but for boiling gas was cheaper. The difference was not very great in the ovens so long as they remained at full heat. This, however, is only used for running up to cooking temperature, which is only for a small portion of the time the oven is in use. While cooking is actually going on, the electric oven is costing 50 per cent. less than the gas oven. There was a movement in America to introduce thermostatically-controlled ovens, but these had not as yet found much favour in this country.

The latter part of the Paper dealt with electric water-heating, and described one or two forms of apparatus, including the continuous load type with thermal storage, the thermostatically-controlled tank heater, and the geyser type, in which the water is heated as required.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Modern Illuminants and Illuminating Engineering. By L. Gaster and J. S. Dow. 462 pp. 9 in. by 6 in. 204 figures. (London : Whittaker & Co.) 12s. 6d. net; abroad 18s. 6d.

Engineering has been defined as common sense applied to the use of materials, and from prehistoric times onward, men have been applying varying amounts of common sense to artificial lighting; although it is only lately that a certain class of those whose business it is to arrange lighting schemes have dignified themselves by the title of illuminating engineer. The subject is, however, one that has developed enormously in the last few years as electric and other forms of lighting have been perfected, and an increasing amount of attention is being paid to the proper utilisation of the means which electrical, gas, and other engineers have provided. The authors deal with the subject from many points of view in this comprehensive work, which commences with a chatty little history of artificial lighting, and concludes with a variety of photographs of actual interior and exterior installations. The body of the book describes in detail many commercial forms of electric, gas, oil, petrol, and acetylene lamps, and a useful chapter sets in order one's ideas as to the physiological effect of light on the eye. Another important section deals with the quantitative estimation of light and illumination, incidentally describing many forms of photometer. Globes, shades, and reflectors are then dealt with. Having thus considered the production and measurement of light, the authors proceed to examine its application, and discuss in detail the apportioning of illumination with aesthetic satisfaction to practical needs.

If the work is a little discursive at times, we must forgive this in our appreciation of its completeness, and the valuable index that it forms both by means of references and a bibliography to the already extensive literature on the subject. It must be understood that the book attempts neither to be a scientific treatise on optics nor a manual for the lamp manufacturer, but there must be many to which it will appeal, as dealing generally with problems of practical illumination.

A Treatise on the Theory of Alternating Currents. By A. Russell. Vol. I. 534 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{4}$ in. 163 figures. (Cambridge: The University Press.) Second Edition. 15s. net; abroad, 15s. 8d.

In the first edition of this work, eleven years ago, Dr. Russell made it his object to collect together and examine the mathematical theorems which bear on the applications of alternating currents to practical work, and it is natural that in the present edition he has been obliged to extend his range to keep pace with recent developments. This applies more particularly to high frequency currents as used in telephony and wireless telegraphy. There has been a good deal of other revision, and several chapters have been entirely rewritten, and the mathematical treatment, which deals with such refinements as elliptic integrals and *ber* and *bei* functions has been in places somewhat extended. With the advance of modern developments, mathematics is becoming more and more the weapon of the engineer, as well as the delight of the theorist, and a book of this kind has more real practical value than might appear at first sight.

The Mathematical Analysis of Electrical and Optical Wave Motion. By H. Bateman. 159 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{4}$ in. 6 figures. (Cambridge: The University Press.) 7s. 6d. net; abroad, 7s. 10d.

The author deals with recent developments of Maxwell's electromagnetic theory directly connected with the solution of the partial differential equation of wave motion, but stops short of the higher developments of the theory, which are based on the dynamical equations of motion. Part of the latter portion of the book bears on the problem of the structure of the aether, and the difference between positive and negative elementary static charges, and not the least interesting part is the author's own work on the subject.

Submarine Vessels, including Mines, Torpedoes, Guns, Steering, Propelling, and Navigating Apparatus. By W. E. Dommett. 106 pp. 7 $\frac{1}{2}$ in. by 4 $\frac{1}{2}$ in. 21 figures and 16 plates. (London: Whittaker & Co.) 1s. net; by post, 1s. 2d.

At the present time this little work will appeal to many who wish to know more about the weapon of naval warfare, which has been developed to such perfection by the British Navy and put to such base uses by the Germans. Its style is much better than the usual book on technical matters addressed to the non-technical public, and in particular the short section on the electrical means by which under-water propulsion is effected is clearly written, although of necessity many things that electrical engineers will want to know are left unexplained. Some interesting exploits both of our submarines and in the way of defence against the "U boats" of the enemy are hinted at, but here again it is not good for us, at present, to know too much.

Advertising and Progress: A Defence by E. S. Hole, and a Challenge by J. Hart. 271 pp. 8 $\frac{1}{2}$ in. by 5 $\frac{1}{4}$ in. (London: Review of Reviews.) 5s. net; abroad, 5s. 5d.

One of the main objects of the authors of this book is to destroy the "superstition" that the consumer pays for advertising, and to advance the contrary proposition that "the burden of successful advertising is borne by the unprogressive manufacturer or merchant, who is unable to recognise the advantages of good advertising, and a part of whose trade is taken by the successful advertiser." This contention may seem remarkable, but a perusal of the work, which reveals an absolutely new and unconventional treatment of the subject, will convince many readers that it is by no means unjustifiable.

The authors are even fortunate in their mistakes. Advertising is likened to the flywheel of an engine, on the absolutely unparable supposition that the flywheel increases the available power for the same expenditure of fuel. But the analogy is a very suitable one, nevertheless. A heavy flywheel not only enables the engine to meet momentarily excessive demands upon it, but can also prevent waste of energy and fuel during momentary diminutions of output.

The book was written and published before the war. Had it been written later, the authors could have pointed out that the manufacturers who had been regular and ubiquitous advertisers suffered the least by the commercial upheaval of last August. There will be another critical time when the war is over, and then those who have advertised consistently and persistently during the war period will have the least cause for anxiety.

Portland Cement.—A new edition of the British Standard Specification (No. 12) for Portland cement has been issued by the Engineering Standards Committee, and can be obtained at the price of 5s. Certain changes in the minimum allowable tensile strengths and the construction of test briquettes have been made, and the growth of tensile strength with time is specified in a new formula.

MARKETING GOODS ABROAD

AT a meeting of the Sales Managers' Association on Friday, Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Canada, gave an address in which he outlined some of the difficulties from which British manufacturers are suffering in their trade relationships with foreign countries and the Colonies. In March Mr. Wickes was good enough to afford us a special interview (ELECTRICAL ENGINEERING, March 11th, p. 109), in which he discussed with our representative some of the trading conditions in Canada, particularly in respect to the electrical industry. In his address on Friday, however, Mr. Wickes was more general, and did not deal with any specific industry, foreign country, or colony. Mr. Arthur M. Samuel, who was in the chair, urged the adoption of the decimal system of weights and measures as likely to facilitate trade abroad, and also pleaded for a change in our educational system as regards salesmen sent out from this country. As an instance he deplored the lack of an institution in this country for the training of young men in Oriental studies, having regard to the enormous trade carried on between this country and India.

Mr. Wickes said that British trade to-day was largely permeated with the leisurely ideas which held sway during the eighteenth and the early part of the nineteenth centuries. At the same time the necessity for some change in our method was now being recognised. The criticism which had often been made of our Consular service, although to a certain extent true, did not absolutely strike at the root of the matter. The manufacturer himself was very largely to blame in many respects. The great drawback to British trade abroad had been the class of salesmen sent out from this country, or the absence of merchants to deal with the goods, especially those of the heavier kinds, which did not pass through the hands of a retailer but went direct from the importer to the user. It was a curious fact that in those countries where British goods were adequately represented by merchants we held our own quite easily with foreign goods, but the reverse was the case where the merchants dealing with British goods were not sufficient. In order to get over this difficulty he suggested that firms manufacturing different goods, but coming within a similar category, should combine and make arrangements with a merchant in those countries where they were not at present obtaining a sufficient volume of trade who would adequately represent their interests. Another matter which must be re-arranged was that of credit. The number of British firms who would give credit to the extent that other countries did were few and far between, and the representatives of the U.S. Commissioners of Trade attributed a great deal of the success of American goods to the credit extended to customers. Another outlet for British trade abroad was that where loans were asked for in this country, there should be some stipulation that the goods should be purchased here. For instance, the recent Canadian loan of £5,000,000 for wharves and landing-stages at Halifax and St. John, so readily taken up here, did not have any condition attached that the necessary plant and machinery should be purchased in this country. British manufacturers should also take the trouble to translate their money values into those of the country where the price lists were sent, and particulars should also be given as to freightage costs, so that the buyer knew exactly what the goods would cost him in his own town. It was a curious thing that the British shipping companies did not issue a freight list, and most exporters had to adopt the freight list issued by the German shipping companies as a guide. Mr. Wickes hinted at the necessity for some change in our fiscal system on behalf of British trade, and also some restrictions upon foreign firms being allowed to trade here under British names and competing in our domestic markets with imported goods.

Glass Manufacture.—The Council of the Institute of Chemistry has published a report dealing with the work of the Glass Research Committee appointed last October to conduct investigations as to the best formulæ for the composition of laboratory glassware, miners' lamp glasses, combustion tubing, resistant glass for pharmaceutical products, glass for X-ray bulbs, &c. An immense amount of experimental work has been done in arriving at these, with the result that full information is now available for the manufacture of all the important glasses used in the laboratory and for industrial purposes, which have hitherto been mainly obtained from abroad. Copies of the report can be obtained from the Registrar, Institute of Chemistry of Great Britain and Ireland, 30 Russell Square, W.C.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,438.

Could any reader describe in detail the apparatus used in taking the ohmic resistance of an electrolyte of fused salts, especially the apparatus containing the salt?—"ELECTROLYTE." (Replies must be received not later than first post, Thursday, April 22nd.)

ANSWERS TO No. 1,436.

I have recently been testing a small four-pole revolving-armature three-phase generator (A.C.). During the tests the question arose as to whether the machine was star- or mesh-connected. Several methods of ascertaining this were suggested, but none gave conclusive results. Is there any conclusive test which can be simply applied?—C. W.

The first award (10s.) is given to "M. M." for the following reply:

Presuming it is impossible to follow course of windings, we must have recourse to an electromagnetic method. It might at first be thought that the desired result could be attained by measurement of resistance, i.e., by taking resistance between ring *a* and ring *b*, and then between *a* and rings *b* and *c* joined together. This, however, gives same ratio both with star or mesh. As we do not know resistance per phase, this is of no use. An electromagnetic method is as follows:—Send a current from ring *a* to ring *b*; if the armature exhibits polarity (which may be made evident by a small compass), armature is in mesh. If in star, the effect due to one phase would be wiped out by the magnetic effect due to the other. Now connect—that is, short-circuit—rings *b* and *c*. Send a current from ring *a* to the rings *b* and *c*. If the armature is in mesh, it will exhibit two poles; if in star, there will be no polarity, as the return flowing back through two phases will neutralise current in remaining phase.

No second award is made.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A further article by Lieut. A. A. Jayne, "With the Expeditionary Force," appearing in the April number of the *Telegraph and Telephone Journal*, gives evidence of the importance of the field cable work, and the coolness and intrepidity of the men engaged on it. Repairs have to be executed in areas immediately behind the trenches, swept by rifle fire, "Jack Johnsons," and shrapnel. To be a passive target in

an open field and at the same time to make a good joint in a wire is surely a good test of courage.

Along the trenches telephonic communication is usual, and the operators may find themselves in the thick of the fighting; if a trench has to be vacated, the telephone man is not by any means the first out, as he must not leave his speaking set behind. A Divisional Signal Company consists of headquarters and four sections. No. 1 Section consists of three cable detachments, who connect four divisions to each of the three brigades, and the remaining three sections called Brigade Sections communicate with the battalions in each brigade, in the trenches or wherever they may be. Each Brigade Section has two telephone detachments and eight despatch rider cyclists. The telephone detachments have a pack mule or pony, which carries three miles of cable.

From the Brigade Headquarters to the trenches, or wherever the battalion headquarters may be, cables are at first laid out on the ground. This where possible is done at night, cable D 5 gauge being used. Afterwards they are lifted on to 'sticks.' It is not at all an easy matter to lay cable during the night, as may be supposed. There are small woods, undulations in the land, ditches, and dykes to negotiate; men being relieved from the trenches and others passing along to effect the reliefs, ration parties, and other difficulties have to be contended with. During this first stage of communicating with the trenches the cable is pegged down to the ground. Obviously it must lie evenly on the ground everywhere or someone may trip up and break it. When roads are crossed the cable must be raised at least 15 feet—soldiers going to their posts in the dark often use the cable as a guide or they inadvertently walk into a pole at a crossing—in both cases some derangement of the line frequently takes place. After a time troops learn to avoid the cable, and similarly, when it is known what tracks are being used, the cable is raised on poles and moved out of the way. Often during the night the linemen have to grope along to trace and repair a fault caused by shell fire.

No. 1 Section marches with the brigade when they are on the move, and communication with the division is kept up by means of the cable, which is continually run out, often on to the side of the road. When, however, the various headquarters remain stationary, any permanent lines that may be running along the route are utilised. This is easily accomplished because it is known that only the enemy is in front, and therefore no inconvenience will be occasioned to people that matter by cutting and terminating the wires. Of course, it frequently happens that there are no permanent wires along the road, and then cables on poles are used. The number of poles carried by a section is limited, and hop poles and props are borrowed or bought from farmers and others. Suitable sticks are also cut from hedges, &c.

From Divisional Headquarters to Brigades buzzers are worked, but on the lines to Corps Headquarters single current sounder sets are now being used. From the Army Headquarters to the Corps, where there is frequently very heavy traffic, the Second Class Office baseboard set has actually been converted to duplex. The capacity on such lines is negligible, and the insertion of a rheostat for the compensation circuit acts splendidly. All that is necessary is to move the sounder from the baseboard for the convenience of the receiving telegraphist and in its place put the rheostat.

Among the examples of dangerous work mentioned, the following is worth quoting:—"On one occasion it was the duty of a section to proceed up a road across an open field and down another road, thence to connect with its headquarters. The cable wagon laid the cable down the first road and turned into the field and immediately became the centre of shell fire. The only thing to do was to clasp on speed and pay out the cable. Away jolted the wagon and got across when the officer discovered that his small stock of poles had slipped off. 'About turn and pick up poles.' Again the area shelled was successfully done and they started down the next road. 'Don't you go down that road,' shouted a despatch rider, 'Jack Johnsons are coming straight up the road like hailstones.' 'All right,' said the officer, 'we will pay out under this ridge.'"

An article by Mr. J. H. Watkins in the April number of the *Post Office Electrical Engineers Journal* describes a call-office call-box for use on automatic exchanges. The caller "dials" for the number he wants, and can hear the called subscriber's reply, but until he has deposited his penny there is a short-circuit across the call-office transmitter, so that he himself cannot speak on the line. In addition, there is a 30-ohm shunt across the receiver, so that this cannot be used as a transmitter.

According to the *Yorkshire Observer*, the installation of the automatic exchange in Leeds has had to be postponed. Among the reasons given is the large number of men who have been taken for telephone and telegraph purposes in France and the urgent need for placing the telephone and telegraph wires in Leeds underground. The latter is considered more important than installing the automatic exchange.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 8th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

6,443/14. Tramcar Brakes. A. W. E. MALEY and G. N. CADBURY. A regenerative electric brake and a track brake are controlled by the same handle, preferably the handle of the driving controller, in such a way that the regenerative brake cannot be applied before the track brake, nor so as to produce skidding. (Three figures.)

6,659/14. Telephony. T. G. MARTIN. A system of cord circuit connections for semi-automatic telephone systems, in which the working of the "busy" signal is not dependent on the position of the operator's listening key. A supervisory relay is arranged to be energised in series with the line relay of the connecting switch, and means are associated with the connecting switch for alternately applying the signal current and short-circuiting the supervisory relay so as to give the busy signal. (One figure.)

13,348/14. Electrically-heated Vulcaniser. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. and H. SAVAGE. An electrically-heated apparatus for vulcanising cable joints, tyres, &c., by immersion in a bath of molten wax, having a vulcanising vessel within an outer vessel, in which are placed the heating resistances. (Three figures.)

19,878/14. Insulating Material. W. TEGGIN and LONDON ELECTRIC WIRE CO. & SMITH'S, LTD. This material is composed of superimposed combed or carded cotton wool or a mixture of cotton and wool on asbestos sheet, the whole impregnated with rubber solution under pressure. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: COLLIS and CROMPTON & CO. [Protective apparatus] 9,065/14.

Electrometallurgy and Electrochemistry: GMÜR-ZEHNDER [Resistance furnaces] 23,495/14.

Heating and Cooking: QUAIN [Heaters] 4,017/14; NEGUS and NEGUS [Ovens] 9,213/14 and 1,376/15.

Switchgear, Fuses and Fittings: COLLINSON [Resistances] 29,622/13; GOLBY (Wizard Electric Lamp Co.) [Lamp stand] 4,758/14; WEISSMANN [Lamp supports] 7,311/14; CURTIS, MACKLEY and IGRANIC ELECTRIC CO. [Controllers] 20,132/14.

Traction: STABIE [Train control] 4,131/14.

Telephony and Telegraphy: BETULANDER AUTOMATIC TELEPHONE CO. and BRYANT [Impulse transmitters] 7,218/14; WESTERN ELECTRIC CO. (W.E. CO., U.S.A.) [Printing telegraphs] 7,907/14; PRITCHARD [Telephone transmitters] 7,974/14; PLEIJEL and OLSSON [Loading duplex telephone circuits] 8,184/14.

Miscellaneous: GREVILLE [Current control for electro-medical purposes] 4,542/14; SCOTT [Electrical steering gear] 6,424/14;

CATALOGUES, PAMPHLETS, &c., RECEIVED

GEARING.—A well-illustrated booklet from David Brown & Sons (Lockwood, Huddersfield) gives a very large amount of information regarding double helical gear and its application as a high-efficiency speed reducer.

THE BRILL MAGAZINE.—The last number of this interesting publication of the J. G. Brill Co. (Philadelphia), whose name is known all over the world in connection with tramcar trucks, &c., contains a number of illustrated articles describing rolling stock and other features of American electric interurban and street railways.

LIQUID STARTERS.—Two forms of liquid type motor starters are described in a leaflet from J. H. Holmes and Co. (Portland Road, Newcastle-on-Tyne).

DYNAMOS AND MOTORS.—A leaflet from the Millns Elec-

HARDING [Indicating apparatus] 8,526/14; CAMPBELL [Electric safety control for steam engines] 10,516/14; ESTER & CO. and STROHMEYER [Apparatus for converting electric currents] 20,308/14; FARNSWORTH and SCHUSTER [Vapour electric devices] 1,869/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Heating and Cooking: LANDIS & GYR A.G. [Electric heating and cooking apparatus] 3,855/15.

Switchgear, &c.: BOZZETTI [Switches] 4,012/15.

Telephony and Telegraphy: DIXON [Printing telegraph receivers] 3,987/15; HULTMAN [Automatic telephone exchange system] 4,285/15.

The following Amended Specifications can now be obtained:—

Instruments: B. T.-H. CO. [Induction meters] 16,409/04.*

Telegraphy: G. O. SQUIER ["Wired" wireless telegraphy] 17,487/14.

Opposition to Grant of Patents

22,331/13. Lamp Filaments. C. O. BASTIAN. A grant has been allowed on this application, in spite of opposition. The specification describes helically-wound drawn-wire filaments, in which the wire is provided with a coating during preparation to keep the convolutions apart. This coating is removed after mounting the filament.

7,677/14. Resistances. J. COLLINSON. A grant has been allowed on this application, in spite of opposition. The specification describes a method of construction of grid-type resistances.

21,029/13. Lamp Filaments. C. O. BASTIAN. A grant has been refused on this application. The specification describes lamps with wire filaments in helical form, with the convolutions arranged at a distance from one another equal to, or less than, one-half the diameter of the wire.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

7,966/01. Train Control. E. R. HILL. This patent covers a number of improvements in details of electro-pneumatic multiple unit control systems for electric trains.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: F. DIXON [Flywheel power equalisation] 28,349/04.

Dynamos, Motors and Transformers: ELEKTRICITÄTS A.G. VORM, W. LAHMEYER & CO. [Single-phase motors] 25,393/05.

Heating and Cooking: B.T.-H. CO. (G.E. CO., U.S.A.) [Heating apparatus making use of iron losses as well as resistance] 29,120/06.

Telephony and Telegraphy: J. PETICKY, L. CIZEK, and F. SUCHÁNEK [Automatic telephones] 28,036/04; F. RITCHIE [Electric order telegraph] 28,254/04; J. PETICKY, F. SUCHÁNEK, and L. CIZEK [Automatic telephones] 11,497/09; E. BLOS [Automatic telephones] 29,801/09; AMERICAN AUTOMATIC TELEPHONE CO. and C. L. GOODRUM [Automatic telephones] 29,963/09.

trical Co. (37 and 38 Strand, W.C.), which business was recently started by Mr. P. N. Millns, late of the Adnil Electric Co., Ltd., gives prices of a line of British-made continuous-current dynamos and motors from $\frac{1}{2}$ to 300 h.p. These machines are all fitted with interpoles, and a large number of ratings are standardised. We understand that very prompt delivery can be given.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

TELEPHONE CARD.—A neat telephone card is being issued by the County of London Electric Supply Co., Ltd., on which the telephone numbers of the Company's head and branch offices are printed, and space left for filling any numbers likely to be in frequent use.

DYNAMOS AND MOTORS.—A list of continuous-current dynamos and motors of moderate size is to hand from Higgs

Brothers (Dynamo Works, Sherbourne Road, Balsall Heath, Birmingham). The list contains full specifications of the firm's machines, and a very convenient way of listing the outputs by means of an output factor for each size of carcase to be multiplied by the speed within a certain range is used.

DYNAMOS AND MOTORS.—A considerable number of continuous and alternating current machines ready in London for immediate delivery are detailed in a special stock list from Marples & Leach (26-30 Artillery Lane, E.C.).

STEEL WIRES.—A new list of steel wires, rods, &c., for hardening and tempering is being issued by W. H. Brunton and Son (Musselburgh, Scotland), who will send a copy to any of our readers who are interested.

FANS.—A new illustrated descriptive price list of electric fans has been issued by the British Thomson-Houston Co., Ltd. (Rugby), and includes fixed and oscillating bracket and table fans, for alternating and continuous current, as well as porthole pattern exhaust fans, ceiling fans, and other special designs. The oscillating movement is obtained by positive gearing and is not dependent upon air reaction.

SUPPLIES AND NOVELTIES.—Leaflets from Krupka & Jacoby, Ltd. (39 Victoria Street, Westminster), deal with enamelled iron shades, flash-lamp novelties, and pocket-lamp batteries. Special attention should be drawn to a miniature flash-lamp, resembling a fountain-pen in appearance, 5*g* in. long and 11/16 in. in diameter.

THE SPRINKLER BULLETIN.—The last issue of this quarterly publication of Mather & Platt, Ltd. (Manchester), deals to a large extent with electrical matters and gives illustrated descriptions of a number of forms of continuous and alternating current motors made by them, as well as generating plant and a variety of electrically-driven machinery. Electrical driving is also dealt with in the sections devoted to the pump and textile departments. It is interesting to note that 525 of the firm's staff and employees have joined the Forces.

POCKET WAR MAPS.—A useful little booklet of maps of the areas of war, which incidentally calls attention to their cables and other products, is being circulated by W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C., and will be sent to any of our readers who apply on their printed letter heading.

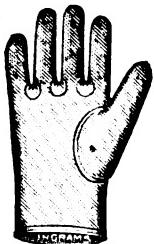
DYNAMOS.—An illustrated descriptive pamphlet from the British Thomson-Houston Co., Ltd. (Rugby), deals with their latest pattern of multipolar continuous current generators of moderate size, giving full specifications of their construction, with dimensions and weights.

METAL FILAMENT LAMPS.—The British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), have issued revised price lists of British-made Mazda drawn wire lamps, including ordinary, high candle-power, candle, tube, sign, marine, and traction lamps, and also a list of "half-watt" lamps in sizes from 100 to 500 watts for 50 to 60 volts, 200 to 1,500 watts for 100 to 130 volts, and 500 to 1,500 watts for 200 to 225 volts. These lamps are also made at the company's factory at Rugby, which is briefly described in a leaflet accompanying the price lists.

Islington Civic Guards.—Hearing that this body are looking round for a rifle range, Messrs. A. P. Lundberg & Sons have offered the free use of a very suitable strip of ground adjacent to their Pioneer Electrical Works. The matter has been referred to the Parliamentary Committee of the Islington Borough Council.

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.



Made in
all sizes of
Ordinary & Stout
Substances
to suit varying
Volts.

BEST QUALITY
INDIA-RUBBER.

Prices on Application.

Manufacturers—

J. G. INGRAM & SON, Hackney Wick, LONDON, N.E.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Abercynon.—Tenders for the following are required:—E.H.T. underground cables, L.T. overhead lines, and public lighting; E.H.T. and L.T. switchgear and transformers. Consulting Engineer, H. H. McLeod, Portishead, near Bristol. April 26th.

Ballymena.—The Treasury has sanctioned a loan of £3,800 for an electric lighting installation for the Guardians.

Bexley.—A 50-kw. rotary converter is to be installed at an estimated cost of £350. The bulk of this is to be met out of revenue and the balance out of unexpended borrowing powers.

Dover.—A L.G.B. inquiry concerning a loan of £6,000 for a new generating set was held yesterday. In anticipation of the possibility of the loan being refused in present circumstances, the Borough Electrical Engineer has been considering what other steps he can take to meet the demands for which the new generating set is required.

East Grinstead.—An inquiry was held last week into the Council's application for an Electric Lighting Provisional Order. The estimated expenditure is £10,000.

Ireland.—A few further particulars are available of the electric power scheme for Ireland, referred to on p. 147 of our issue for April 1st. It is stated that all the agreements for the necessary land have been signed, but that it is not the present intention to go to the public for any part of the £2,000,000 capital. Presumably, however, the Company will have to go to Parliament to enable it to carry the scheme out.

Leigh (Lancs.).—A loan of £2,813 is contemplated for plant extensions.

Middleton.—An expenditure of £3,000 is contemplated on mains.

Wigan.—A loan of £6,000 is required for two new boilers at the electricity works.

Wiring

Edgware.—Wiring of Redhill Institution for Hendon Guardians. Clerk, Union Offices. April 29th. (See an advertisement on another page.)

Hull.—Wiring and fittings for secondary school, Cottingham Road. City Architect. April 29th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Ayr.—Hospital, Hunter's Avenue.

Dundalk.—County offices.

London.—School at Tulse Hill. Architects, Hine & Pegg, 35 Parliament Street, S.W.

Stockport.—New offices for Prudential Assurance Co.

Miscellaneous

Australia.—The Melbourne Electric Supply Committee requires 1,207,900 arc lamp carbons. Further particulars at 73 Basinghall Street, and tenders to Messrs. McIlwraith, McEacharn & Co., Biliter Square Buildings, E.C., by April 21st.

Great Indian Peninsula Railway Co.—Twelve months' supply of lamps and fittings. Secretary, 48 Copthall Avenue, E.C. April 22nd.

Spain.—Six electric cranes and four electric capstans. Tenders to the Presidente de la Junta de Obras del Pantano del Chorro, Alameda 13-15, Malaga. Further particulars at 73 Basinghall Street, E.C.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Aberdare.—The following tenders have been accepted:—Cables, joint boxes, &c., Callender's Cable & Construction Co.; meters, Landis & Gyr; oils, Vacuum Oil Co.

Belfast.—A twelve months' contract has been placed with Venner Times Switches, Ltd., for time switches.

Croydon.—The Tramways Department has placed a con-

tract with Siemens Bros. Dynamo Works for a twelve months' supply of Wotan, Tantulum, and carbon filament lamps.

Hove.—The Electricity Committee recently invited tenders for a turbo-generator. The tenders received show that the prices are generally higher by some 20 per cent. than three months ago, whilst all dates for delivery are provisional. Taking this into consideration, together with the Treasury request that capital expenditure should be curtailed, the Committee recommend that the installation of the proposed set should be postponed until a later date. The Committee, however, is of the opinion that a battery should be installed, and the tender of the Tudor Accumulator Co. at £701 is recommended for acceptance.

London: Hammersmith.—Ten firms tendered for meters, and that of the Electrical Apparatus Co. for a supply for three years is recommended for acceptance. The prices of the successful tender are:—3-ampere meters, 24s. each; 5-ampere, 24s. 6d.; 10-ampere, 25s. 9d.; 25-ampere, 28s. 6d.; 50-ampere, 36s.; 75-ampere, 43s. 6d.; 100-ampere, £2 10s. 6d.; 250-ampere, £4 6s.; and 500-ampere, £5 1s.

Mile End.—The tender of Baxter & Caunter, the only firm tendering, has been accepted by the Guardians for electrical fittings at £114 18s.

Pontypridd.—Contracts have been placed with Messrs. Lucy & Co. and the British Insulated & Helsby Cables, Ltd., for joint-boxes and cut-outs.

Tunbridge Wells.—A contract is to be placed with the British Thomson-Houston Co. for a 300-kw. steam alternator and condensing plant at £3,132.

Messrs. Ferranti, Ltd., have received orders for ordinary and prepayment meters for the year to March 31st, 1916, from the Bristol, Croydon, Londonderry, Plymouth, and Whitehaven Corporations, the Hammersmith Borough Council, and the Ilford Urban District Council.

The Mansfield Corporation and the Walthamstow and Holyhead Councils have placed orders for Chamberlain & Hookham meters for twelve months with Messrs. Venner & Co.

APPOINTMENTS AND PERSONAL NOTES

The Royal Society of Arts has conferred the Albert Medal upon Mr. G. Marconi for his services in connection with wireless telegraphy.

Mr. V. F. Bush, Assistant Mains Engineer at West Ham, has been appointed Assistant Electrical Engineer at Redditch at a salary of £170 per annum.

Mr. H. C. Ashton, who was appointed in September as temporary meter assistant in the Hammersmith Electricity Department in the absence of Mr. H. R. Watts, enlisted, is to be placed upon the permanent staff and transferred to other work on Mr. Watts's return, at a salary of £175 per annum.

A shift engineer is required at Wednesbury; an engineer for a works in Wales; and assistant electrician at the Park-end Deep Navigation Collieries; and wiremen by John Brown & Co.

LOCAL NOTES

Belfast: Electricity Staff Reorganisation.—The Electricity Committee, which has had the reorganisation of the Electricity Department under consideration for some eighteen months, has now, through inability to agree upon a scheme, been compelled to ask the Corporation to deal with the matter in Committee. It appears from a report by the Committee which was on the agenda at the last meeting of the Corporation that four members of the Committee had voted for a



motion, and eight against, that no scheme should be submitted which included the Chief Electrical Engineer in his present position. Another motion, however, that the present Chief Assistant be relieved of his duties and assigned to others was passed, together with a recommendation for the appointment of a Chief Assistant Engineer to be mainly responsible for all electrical and mechanical repairs, at a salary of £450 per annum. In the course of a short discussion at the last meeting of the Corporation, during which this report was deleted from the agenda, leaving the Corporation to deal with the matter completely, it was pointed out that no charge had been preferred against Mr. Bloxam by the Committee.

Boston: Electric Lighting.—The Board of Trade, in sanctioning the Council's application for an Electric Lighting Order, has stipulated that it cannot come into operation before the close of the war.

Chichester: Reduced Street Lighting.—In reply to the Council's application for a reduction in the charge for public lighting owing to the fewer number of lamps in use, the Chichester Electric Lighting Co. points out that the increased cost of generating the public lighting units since the war has amounted to £267, against which the saving effected by the Company does not exceed £70. The Council has deferred the next payment for public lighting under the contract until some arrangement has been arrived at, but the directors retort that there is no legal or other justification for such an action.

London: Marylebone: Increased Charges.—The Electric Supply Committee recommends an increase of 10 per cent. in their charges, the reason being that they expect a considerable reduction in the private lighting demand in the near future.

Newport (Mon.): Electricity Estimates.—Mr. A. Nichols Moore, the Borough Electrical Engineer, states that since the presentation of the annual estimates for 1915-16, which show a net loss of £1,164, the price of coal has steadily advanced and seems likely to go still higher. The loss mentioned above was arrived at by taking coal at 12s. per ton. We understand that the Committee recommends an increase of 20 per cent. in the charge for current after the June quarter.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £78 10s. to £79 10s. (last week, £76 10s. to £77).

Advance in Prices.—The Sterling Telephone & Electric Co., Ltd. (210-212 Tottenham Court Road, W.), announce a general advance of 10 per cent. on their catalogue prices with the exception of a few special items, for which new list prices are in force.

Liquidations.—A meeting of Safety Light, Ltd., will be held at 62 London Wall, E.C., on May 10th, at 12 noon, to hear the liquidator's account of the winding up.

German Trade.—The Imperial Trade Correspondent at Quebec reports having received inquiries from seven firms in Canada respecting the transfer of their trade from German and Austrian to British manufacturers. The goods dealt in include electrical apparatus of all kinds. Further particulars at 73 Basinghall Street, E.C.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Companies Struck off Register.—The name of the Automatic Telephone Co. is to be struck off the register of joint stock companies at the end of three months. This, of course, is not the Automatic Telephone Manufacturing Co., whose accounts for 1914 were dealt with in our issue for April 1st, p. 145.

London Electric Supply Corporation.—The shareholders are being offered £100,000 four per cent. first mortgage debenture stock at 85 per cent. The Treasury has given sanction to this issue, which is required mainly in connection with liabilities upon plant for the electrical working of the London, Brighton & South Coast Railway.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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Other Colonies and Abroad. 13s. per Annum.

Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES AND TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, Fleet, London." Telephone No.: 5509 Holborn

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

We invite readers to enrol themselves in the "Electrical Emergency Service." The object of the Service is to provide part-time volunteer switchboard attendants, and so to release men who have hitherto been refused permission to join the Colours (p. 170).

EXTENSIONS of plant have been recently installed in the Carlisle electricity works, including a high-speed turbo-alternator with rotary wet-air filter, two rotary converters with special arrangements for running inverted, and a new form of voltage regulator (p. 171).

IN a Paper on "Artificial Illumination and Architectural Effect," last week, Mr. S. D. Chalmers disapproved of completely concealed methods of lighting (p. 172).

A PAPER on "Electric Power in India," by Mr. H. R. Speyer, reviews the causes of backwardness of the conversion of the cotton and other mills to electric driving, and discusses the conditions of electric power supply in that country generally (p. 172).

AT the annual meeting of the Electrical Trades Benevolent Institution on Monday, Mr. E. Garske called special attention to the slow progress of the Fund, and suggested various methods of increasing the income (p. 173).

SOME technical books are reviewed in this issue (p. 173).

A PROPOSAL for revised power charges in Bedford, made by the Electricity Committee, was opposed by the Mayor last week, but was carried notwithstanding.

During the discussion the Town Clerk expressed the opinion that a coal clause was not admissible in a power contract unless it applied to all consumers alike (p. 173).

ACCEPTANCE test for generators are discussed in our Questions and Answers columns (p. 174).

AMONG the subjects of specifications published by the Patent Office last Thursday are resistances, heaters, and the loading of duplex telephone lines. A patent for a cut-out for inserting substitutional resistances in arc-lamp circuits, and an automatic telephone patent, expire this week after a full life of 14 years (p. 175).

AN article on telegraphy in war time is reviewed (p. 176).

FURTHER joint working of the London Tube Railways is proposed (p. 176).

REFLECTORS for shop window lighting are described in our Trade Section, which also contains an illustrated article on a half-watt lamp installation and a new system of electrical heating and ventilation (p. 179).

AN expenditure of £30,000 is contemplated at Waterford; £500 at Carnarvon; and £1,300 at Clacton. Generating plant is required in New Zealand (p. 179).

THE repair shops at the Stuart Street power house of the Manchester Corporation have been offered to the Government for the manufacture of shells.—The scheme of reorganisation at Belfast has been referred back to the Electricity Committee. The Dublin Corporation is also asked to reorganise the Electricity Department.—Edinburgh's coal bill will be up by £10,000 for the current year.—Difficulties through enlistments are being experienced at Dundee and Ealing (p. 180).

Arrangements for the Week.—Saturday, April 24th.—Association of Mining Electrical Engineers, Notts and Derbyshire Branch, University College, Nottingham. "Protective Devices Against Lightning and Surges," by E. K. Scott and L. F. Fogarty. 3.30 p.m.

Tuesday, April 27th.—Institution of Electrical Engineers, Manchester Section Annual Meeting, Engineers' Club. "The Bombay Hydro-Electric Scheme," by A. Dickinson. 7.30 p.m.

Association of Supervising Engineers, St. Bride Institute, Fleet Street, E.C. "Lightning Conductors," by H. C. Hands. 8 p.m.

Illuminating Engineering Society, at Royal Society of Arts, John Street, Adelphi. "Visibility: Its Practical Aspects," by C. C. Paterson and B. P. Dudding. 8 p.m.

Wednesday, April 28th.—Institution of Electrical Engineers, Birmingham Section, at the University. "The Bombay Hydro-Electric Scheme," by A. Dickinson. 7.30 p.m.

Institution of Railway Signal Engineers, at I.E.E., Victoria Embankment. Continued discussion on "A Review of the Art of Signalling and Some Suggestions," by Mr. Bound. 2.15 p.m. "Dynamicals," Trocadero Restaurant. Anniversary meeting, 7 p.m.; Dinner, 7.30 p.m.

Royal Society of Arts, John Street, Adelphi. "Utilisation of Solar Energy," by A. S. E. Ackermann. 8 p.m.

Thursday, April 29th.—Institution of Electrical Engineers. "The Bombay Hydro-Electric Scheme," by A. Dickinson. 8 p.m.

Saturday, May 1st.—Royal Institution. Lecture I.: "Photo-Electricity," by Prof. J. A. Fleming, F.R.S.

THE ELECTRICAL EMERGENCY SERVICE

Volunteer Switchboard Attendants Wanted for Part Time Service

ELECTRICAL men who have any leisure time are urgently requested to send in their names to us and to signify their willingness to act as part-time switchboard attendants during the war. Every electrical man, no matter how high his standing in the profession, is begged to respond to this appeal if he has four hours' leisure a day, and if he is willing to be called on to meet the emergency.

There is already a great shortage of switchboard attendants at electricity works, tramway power houses and sub-stations. In some cases men unsuited to the work have had to be quickly taken on, and trained so far as possible, and in other cases the shifts have been lengthened to twelve hours, and the strain will soon tell.

Most electricity works have refused to let further switchboard attendants leave to join the Army, and the War Office has, in many districts, acceded to the request of the electricity works, and actually refuses to recruit any more of their employees. There are thus hundreds of men of military age and eager to serve, being kept back on this account.

The shortage will become more and more acute as the men gradually leave to take on better-paid work in the industrial army making war material, in response to the wide appeals now being circulated.

Temporary switchboard attendants are therefore wanted at once in many electricity works, owing to an actual shortage of men.

Further temporary switchboard attendants will be needed to replace men leaving to work in manufacturing industries supplying the War Office and Admiralty.

Still more temporary switchboard attendants will be required to enable young men working on the switchboards at present to join the army.

The organisation of the Electrical Emergency Service is for the purpose of supplying this need. We are preparing a register of electrical men who are willing to give a portion of their spare time to work as temporary switchboard attendants, and the arrangements as to hours of service will be very similar to those of Special Constables.

Large numbers of men connected with the electrical industry have joined the Colours; others are doing a national service in connection with the manufacture of war material or of apparatus required for its manufacture. There are, however, many electrical men, above the military age, or for some other reason unable to join the Colours, whose time is not fully occupied, and whose desire is to "do something" for the national cause, in which the technical knowledge they possess will be of utility.

The men who register in the Electrical Emergency Service, and whose offer for the above work is accepted, will be giving service of even more immediate need to the nation than the numerous Volunteer Training Corps, and quite equal to the self-sacrificing work performed by the Special Constables all over the country.

Mr. A. L. C. Fell, Chief Officer of the London County Council Tramways, has expressed his approval of the Electrical Emergency Service, and can already avail himself of the services of a number of members as soon as they are enrolled; we have also already had an application from another electricity works in London.

Applications for enrolment, on the form below, should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

The Service Required.

- A. A full eight-hour shift a day, or—
- B. A half-shift (four hours) daily (1st week morning, 2nd week afternoon, 3rd week night, in rotation).
- C. A half-shift every day, without midnight work.
- D. A half-shift alternate nights with no day work.

To prevent any suggestion of competition with regular employees, wages will be paid in proportion to the existing rates at the works at which the member is employed, and to the time given.

A week's notice will be required from any member leaving the Service.

APPLICATION FORM.

(Please cut out, fill in, and return to the Editor of "Electrical Engineering," 203 Temple Chambers, London, E.C.)

I wish to be enrolled as Member of the Electrical Emergency Service.

Age..... Married or Unmarried.....

Qualifications (state electrical experience)

.....
.....
.....

I am willing to work a full shift as (A) (above),

a half shift as (B), (C), (D).

(Delete the line and letters not applicable.)

My regular occupation prevents me at present from giving electrical emergency service between.....a.m. and.....p.m.

Signature

Residential Address

.....
.....
.....

Business Address

(Please write very
distinctly, and give
addresses very fully.)

EXTENSIONS OF PLANT AT CARLISLE

THE latest addition to the generating plant at the electricity works of the City of Carlisle, which was formally inaugurated last week, marks the entry of turbine-driven three-phase plant into the system. These extensions form good examples of up-to-date central station equipment, and comprise one 1,250-kw. turbo-alternator complete with surface condenser and wet-air filter, two 600-kw. rotary converters, high- and low-tension switchboards, a new pipe-line and river sump for condensing water, a new water-tube boiler, and additions to the lighting battery. For the reception of this plant the station building has been prolonged so as to join up to the building used as offices by the Electricity Department, and space is available for the installation of two more sets of the same size.

The turbo-alternator was supplied by the British Branch of the Maschinenfabrik Oerlikon (Switzerland), and is of interest on account of its high speed and small size. It is of similar type to the machines which have already proved their economy in steam consumption in the Marylebone Electricity Works, and were described and illustrated in ELECTRICAL ENGINEERING, Vol. IX., p. 675, December 4th, 1913, and Vol. X., p. 646, December 24th, 1914, but is of smaller size. It is rated at a continuous output of 1,250 kw. at 3,000-3,300 volts 50 cycles when supplied with steam at 160 lb. per sq. in. at 100° F. superheat, and as the alternator is of the two-pole type, the set is enabled to run at 3,000 r.p.m. The turbine is of the pure impulse type as developed by the Oerlikon Co. The governing and main throttle valves are worked by oil pressure in a way described in the article referred to above, and an independent run-away trip is provided. Overloads are dealt with by admitting live steam with a bye-pass after the first two stages under control of the main governor. The alternator is also very compact. It is of the two-pole revolving field type, with slotted cylindrical core and distributed winding. It is of particularly substantial construction in view of the high speed. A small exciter is coupled to the machine by a flexible coupling. The alternator is enclosed and ventilated by fans of special design mounted on the rotor. The air is drawn through a wet-air filter described hereafter.

The condensing plant was supplied by the Worthington Pump Co., Ltd., and is designed to deal with 20,600 lb. of exhaust steam per hour, maintaining a vacuum of 28 in. with barometer at 30 in. and cooling water at 65° F. The condenser is of the rectangular two-flow type, having 2,300 sq. ft. of cooling surface, and as no main exhaust valve is provided it has flooding valves on the condenser. The air and hot-well pumps consist of a Worthington 5-in. rotary air pump on the ejector principle, carried upon an operating pump with an attached hot-well pump. The air pump is guaranteed to deal with 17½ lb. of air per hour, at a vacuum of 28 in. The hot-well pump will extract from condenser at the rate of 60 gals. per minute, and deliver against a head into feed-water tank. This machine is driven by one 12½-h.p. Oerlikon D.C. motor running at 560 r.p.m. It is provided with water sealing tank, water being circulated around, and the make-up supply being taken from the circulating suction. The centrifugal pump delivers at the rate of 1,450 g.p.m., and is a 10-in. machine running at 725 r.p.m., driven by a 20-h.p. motor. The condensing plant motors are supplied from the lighting bus-bars, but in the event of failure of supply they are automatically switched over to the batteries. To supply the necessary large quantity of water required for condensing purposes, a new pipe-line and sump have been put down to the river, the suction being 22 in. and the discharge 18 in. diameter respectively. These will supply the water requisite for the three turbine sets when all are installed.

The wet-air filter is of the revolving type, supplied by Heenan & Froude, Ltd. (Worcester). This apparatus does not depend on spraying of the water in any way, but is designed on the principle of utilising wet surfaces of large area close together. The wet surface is contained in a rotating drum of special design, consisting of a cast-iron centre on to which is wound spirally thin galvanised plates, a very small space being left between each layer for the air to pass through. These drums are mounted on a horizontal shaft and rotated slowly, with the lower part in a tank of water, and the air to be filtered passing through the upper part, baffles being fitted so that there can be no leakage of air past the drums. The wet plates comprising these drums take up the most minute particles of dust and foreign matter in suspension in the air, owing to the fact that the velocity of the air through the drums is over the

critical value where a stream-line motion is replaced by an eddying motion, the eddying motion being increased by the splitting up of the stream lines when the air enters the drums, so that every particle of air is thoroughly scrubbed against the wet surfaces, the latter being washed clean by the rotation of the drums in the water. At no part of the process is there created a violent disturbance of water such as might result in loose moisture being given off at the filter outlet.

In order to provide the connecting link between the A.C. and D.C. systems, two 600-kw. Westinghouse six-phase rotary converters running at 750 r.p.m. are installed with the necessary transformers. The converters are arranged for D.C. starting only, and are capable of supplying traction current at 500-550 volts, or lighting current at 460-550 volts, with the middle wire taken back to the transformer, so that an out-of-balance current up to 25 per cent. can be dealt with. They are also capable of running inverted off either supply, and so furnish the alternating supply at 3,000-3,300 volts. A special exciter is mounted on the shaft of each converter, so that when it is running inverted, any undue speeding-up, due to the demagnetising effect of the wattless current in the armature when an inductive load is suddenly thrown on, is prevented. The effect of the exciter is to increase automatically the current in the rotary field when the rotary begins to speed up, and in this manner balance the demagnetising effect of the armature. A further speed-limiting device is fitted in the form of a centrifugal arrangement operating a switch, which causes the no-volt tripping coil of the circuit-breaker to come into action at excessive speeds. In order that voltage regulation may be obtained, a synchronous booster has been provided with each machine.

The switchgear has also been supplied by the British Westinghouse Co. It is placed on an extension of the existing D.C. switchboard gallery, and is arranged so that the H.T. feeder cables are brought direct from the street and in to the cubicles without any intervening cable subway. The high-tension switchgear consists of an operating board, behind which is erected the moulded stone cubicles containing the bus-bars, oil switches, instrument transformers, and isolating links. The cubicles are arranged on the back-to-back system, with a passage-way round the whole structure. Panels are provided for two rotary converters, two turbine sets, two feeder panels, and spare panels for an additional rotary and turbine set. An automatic voltage regulator for the turbo-generator is carried on the same board. This is of a new pattern recently introduced by the British Westinghouse Co. under the Olmsted patents. In this apparatus a main control coil connected across the mains, directly or through a pressure transformer, raises or lowers a core connected to a lever controlled by a spring and a dash-pot. A vibrating lever is also provided, worked like the hammer of an electric bell by a coil taking current from a few accumulator cells. This carries a contact engaging periodically with contact on another spring-mounted lever, the limiting position of which is varied by the main control lever already mentioned. The arrangement is such that the movement of the main lever causes the intermittent contact between the vibrator and the other lever to vary in its duration. This variable contact controls a relay circuit, which actuates the main regulator contacts, which cut the control resistance in and out of its connection as a diverter to the main shunt regulating resistance. The above is an outline of the main principle, but there are naturally various refinements of detail, adjustments, &c. The D.C. board for controlling the rotary converters is situated on the same gallery, but at right angles to the H.T. board. The main machine switch is electrically interlocked with the change-over switch fixed on the rotary, to ensure that both switches are set for lighting or traction as required. The direct-current board is connected to the old board by bare copper strip, suitably mounted on insulators.

We wish to express our thanks to Mr. F. W. Purse, City Electrical Engineer, for his courtesy in supplying us with information regarding the new plant, and also to some of the contractors, notably the Oerlikon Co., Heenan & Froude, Ltd., and the British Westinghouse Co., to whom we are indebted for particulars relating to the portions of equipment supplied by them.

In connection with the Carlisle Electricity Undertaking, it is interesting to record that 30 per cent. of the staff are now serving with the colours, those still employed being furnished with a badge indicating that they are engaged on public service. Below are given the names of the men now with the Forces:—

H. P. Baynham, station superintendent (Royal Engineers);
J. H. Hay, chief clerk (4th East Lancs. Howitzer Brigade,

Cumberland R.F.A.); W. Fraser, storekeeper (7th Batt. Border Regiment); G. Stephens, assistant storekeeper (Border Depôt); H. S. Ballantyne, switchboard attendant (4th Batt. Border Regiment); W. V. Thompson, consumers assistant (Army Service Corps); F. Fairclough, meter reader (4th Batt. Border Regiment); J. Mannion, jointer (4th East Lancs. Howitzer Brigade, Cumberland R.F.A.); R. Baxter, stoker (2nd Batt. Border Regiment); M. Berry, coal trimmer (4th Batt. Border Regiment); R. H. Sanderson, engine-room attendant (4th East Lancs. Howitzer Brigade, Cumberland R.F.A.); A. Wright, coal trimmer (Royal Engineers); J. Simpson, apprentice (4th East Lancs. Howitzer Brigade, Cumberland R.F.A.); G. Todd, apprentice (4th East Lancs. Howitzer Brigade, Cumberland R.F.A.); R. Gem, apprentice (Royal Engineers); W. H. Clark, porter (4th Batt. Border Regiment).

ARTIFICIAL ILLUMINATION AND ARCHITECTURAL EFFECT

IN a Paper upon this subject before the Society of Architects, on Thursday, April 15th, Mr. S. D. Chalmers, head of the Department of Technical Optics, Northampton Institute, London, commented on the little progress made by the illuminating engineer in the application of new methods to purely architectural problems. Hitherto, the production of the illumination requisite for the comfortable use of a room for its ordinary purposes had been the aim, whilst economy had been a prime consideration. Just as natural lighting, however, had led to important architectural developments, so artificial lighting might be equally capable of a success of that character. The great controllability of artificial light was an asset, and he urged architects, at any rate on the more important buildings, to make greater efforts at weaving the lighting effects into the general architectural scheme. He did not altogether approve of indirect lighting except for special purposes, such as drawing offices, and for general purposes preferred the semi-indirect system. This method was specially useful when the ceiling and frieze of a room were worthy of attention in themselves. It was, however, preferable to show the sources of light illuminating the ceiling, even if the greater part of the light be derived from concealed sources. There was a number of cases in London where the ceilings had been lit entirely by concealed lights, and the effect had not been happy.

In the course of a short discussion, Mr. James Darch, an architect, expressed the opinion that architects are too much governed by the engineer in the matter of lighting. Illumination was an art and not a science, and the engineer almost invariably failed on questions of art. The work of the engineer was to produce the illuminant, leaving it to the architect to distribute. Mr. Percy Tubbs said architects would appreciate a table giving the value of various illuminants at different distances. The author pointed out that most lamp-makers supply such information. Messrs. L. Gaster and J. S. Dow urged greater co-operation between architects and illuminating engineers.

ELECTRIC POWER IN INDIA

APAPER on the development of electric power for industrial purposes in India, by Mr. H. R. Speyer, which was originally intended to have been read at a meeting of the Institution of Electrical Engineers, has, owing to the author remaining in India, been published in the *Journal of the Institution*.

Mr. Speyer points out that out of the ninety-five cotton mills and forty-five jute mills, aggregating some 200,000 h.p. at the two great industrial centres, less than 10 per cent. is yet driven electrically. That the large field for electrical driving has not been better covered, the author attributes to British manufacturers having been reluctant to consider seriously the systematic canvassing of the country, and to have been too prone to place the management of their Indian agencies in the hands of commercial men to the exclusion of engineers, with the result that machinery quite unsuited to the conditions prevalent in India has been sent out, causing mill-owners to regard electric driving with disfavour. That there has been a steady increase in electrical imports and decrease in steam imports is clear from curves given in the Paper. Unfortunately, however, of the 66,900-kw. of

plant installed in the five most important supply undertakings in India, Switzerland has supplied 54,000 kw., England only 7,500 kw., and the United States 5,400 kw. of the prime-movers, whilst Germany has supplied no less than 32,000 kw., the United States 17,000 kw., Switzerland 10,000 kw., and England only 7,500 kw. of the electrical generating plant. In the author's opinion, this is due chiefly to the greater standardisation covering a large range of voltages, in many cases from 220 to 6,000 volts, which allows foreign manufacturers many opportunities of putting forward standard plant where British manufacturers are obliged to quote higher prices to cover special construction and require longer times for delivery. The Continental makers, so he says, make a more complete study of the local conditions.

With regard to the climatic conditions in India, it must be remembered that during the "rainy" season, which lasts each year from June to October, the humidity reaches a figure of 95 per cent., with a temperature often of 98° F., and in the mills, factories, and engine-rooms a temperature of 115-120° F. is often recorded. The temperature of water available for condensing purposes during the hot months, even when taken direct from the river or other sources of supply, often reaches 95° F., with the result that in the case of turbine plant it is essential to install condensing plant of much larger capacity than at home. In view of these climatic conditions there has been some difference of opinion whether it was advisable to wind motors for so high a voltage as 6,000. The author takes the view that the insulation of the average low-tension motor to prevent internal short-circuiting between successive turns due to the difference of potential between them is insufficient to prevent the percolation of moisture from an external source, whereas the insulation necessary on 6,000-volt mains to prevent internal short-circuiting due to the potential difference between successive layers is more than sufficient to prevent the percolation of moisture from an outside source.

Another factor which has hampered the development of electricity for industrial purposes in India during recent years has been the lack of English capital for projected industrial enterprises for utilising either water power or coal near the pit's mouth for the generation of electric power for transmission at a cheap rate for mill and factory use. Several proposed schemes are mentioned which were not carried through for this reason. The Tata water-power scheme was carried out with capital raised entirely in India.

There are various local conditions which require plant which would be successful at home to be unsuitable in India. For example, a point often lost sight of is the fact that during the rainy season the average textile mill, after having been shut down on the Saturday afternoon, requires approximately double the amount of power to get under way on the following Monday morning, owing to the abnormal humidity causing the rope drives to tighten during the interval. It is therefore advisable when designing an electric drive with either ropes or belts to allow for the starting gear having an overload capacity of 80 to 100 per cent. The author discusses to some extent the relative advantages of public supply and private plant, holding that where facilities for coal and water supply are adequate, load above 15,000 h.p. can be dealt with as cheaply by private as by public supply. The power load is a great advantage to public supply companies, and the author recommends a system of charging based on a standing charge per h.p. installed, with the addition of a fixed rate for energy used.

A few details are given of the most important power schemes in India. The largest is that of the Tata Hydro-Electric Power Supply Co., whose power-house under construction at Khopoli (Bombay Presidency) will supply 30,000 h.p., and later 60,000 h.p., to the Bombay cotton mills. Water is obtained from the Bhor Mountains through a series of storage reservoirs at a head of 1,700 ft., and Pelton wheels driving 8,000-kw. units will be used. The main transmission will be at 100,000 volts over forty-three miles. The Cauvery power scheme in Mysore has now a station capacity of 16,750 h.p., and transmits power ninety-two miles at 35,000 volts to the Kolar gold-fields. A further 5,000 h.p. is about to be installed. The Calcutta Electric Supply undertaking (see ELECTRICAL ENGINEERING, Vol. IX., p. 661, November 27th, 1913) has a capacity of 15,000 h.p., and the Bombay Tramways & Electric Supply Co. have a station of 12,000 h.p. The largest private generating station is that of the Tata Iron & Steel Works at Sakihi, Bengal. There are a number of electrically-worked tramways in India, but at present no railway has adopted electric traction. Several schemes are, however, being considered by the Indian State-owned railways.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION

THE annual meeting of this Institution was held at the Institution of Electrical Engineers on Monday. Mr. E. Garcke, who presided, moved the adoption of the report and accounts. He said that the total income for the past year amounted to £3,470, compared with £1,362. The income is the largest which the Institution has received in any year since its formation. Twenty-eight grants were made during the year, £252 being paid away, compared with fourteen grants costing £153 in the preceding year. The management expenses were £343 against £247, so that the total outgoings for the year amounted to £595, compared with £400 for the preceding year. The surplus is £2,874, compared with a surplus of £962 for the year 1913, and the total capital of the Institution at the 31st December last was £7,870, as against only £4,996 at the 31st December, 1913. Notwithstanding this comparatively satisfactory result, the funds of the Institution, said Mr. Garcke, were really making very slow progress considering the size of the electrical industry. At present it was quite impossible to relieve even a small part of the distress which exists. It was suggested that all electrical firms should become annual subscribers, and that everyone engaged in the industry should become a member of the Institution. If the 5,000 or 6,000 firms in the industry subscribed five guineas, or even one guinea, they would have a substantial income, or, better still, if everyone in the industry became a member and paid 10s. or 5s. per annum, the Institution would be in a position to give relief to everyone in distress, and to promise a moderate pension to everyone in need of it. Another means might be to ask shareholders in electrical companies—to whom many millions sterling were paid annually in dividends—to agree to a deduction of one penny in the pound as a contribution to the Benevolent Fund. The Chairman concluded by paying a tribute to the work of the Secretary, Mr. F. B. O. Hawes, and to the successful efforts of Mr. H. Hirst and Mr. G. Sutton to raise funds at the recent Festival dinners.

Mr. Justus Eck, in seconding the adoption of the report and accounts, said that three-quarters of those who had been compelled to seek relief from the Fund had been put into permanent employment.

The report and accounts were then adopted.

The following members of the committee retired by rotation, but were re-elected:—E. J. Clark, Guy Burney, H. Bevis, H. H. Berry, Lt.-Col. H. M. Leaf, Lord Vaux of Harrowden, F. J. Walker, R. J. Wallis-Jones, S. D. White.

Mr. H. Bevis, speaking with regard to the slow progress which the Fund was making, pointed out that the amount in hand was more than that of the Institution of Electrical Engineers Benevolent Fund. At the same time, he was far from satisfied, although the present was a most unfortunate period to have to ask for subscriptions.

Mr. Eck said the present intention was to hold a Festival Dinner this year.

A vote of thanks to the Chairman closed the proceedings.

POWER CHARGES AT BEDFORD

IT is not often that the mayor of a town puts himself in strong opposition to the proposals of the electricity committee of his own council, but this happened at the Town Council meeting at Bedford last week in connection with a report as to the price to be charged for power supply. The Council recommended the adoption of proposals by Mr. R. W. L. Phillips, the Borough Electrical Engineer, involving a change in the system of charging. It appears that the agreement with Messrs. W. H. Allen Son & Co. for the supply of power to their works had expired, and the proposal before the Council was that the occasion should be taken to revise the tariff for electrical energy. The change recommended was 1d. per unit be charged up to 300,000 units per annum, with discounts varying from 2 per cent. for a load factor of 12 per cent. up to 20 per cent. for a load factor of 20 per cent. Messrs. Allen would then be entitled to the maximum discount, making the charge to them 0'8d. per unit. Mr. Phillips explained the reasons why power was much cheaper to supply than lighting, and as regards Messrs. Allen's contract, estimated the proportion of fixed costs at the works at £194 per annum, and the works' running cost of supplying 613,250 units at £1,276, making a total of £1,470. The revenue at 0'8d. per unit would be £2,040, leaving £570 gross profit, out of which the capital charges amounting to £260 per annum allocated to their service were to be met.

In the course of his report Mr. Phillips gave some interesting figures relating to the effect of metal filament lamps on the lighting load since 1908. In 1909 the lighting revenue was £879 lower than the previous year; in 1910 there was a

further drop of £304; and in 1911 the lighting revenue was again £188 lower than the previous year. After this it increased again, but had not caught up to the 1908 value until 1913. Without a power load, therefore, there would have been serious deficits.

The Mayor's chief contention was that there would be a loss on the power supply at the price mentioned, and that the profit now made by the electricity works was partly illusory, as the Borough was charged 3'52d. per unit for public lighting. He proposed as an amendment that the price for power be 1d. per unit for all consumers less a 5 per cent. discount. One penny per unit had been the price paid by Messrs. Allen previously, under an agreement made in 1905, and with coal and labour dearer he did not see why this price should not now be charged.

In the course of a long discussion, fully reported in the *Bedford Times and Independent*, it was mentioned that the reason of the high price for street lighting (which the Electrical Engineer had already stated several times in Committee should now be reduced) was that in the early days, when it was laid down, duplicate high- and low-tension cables were run over the whole town, and sufficient copper lay in the streets of Bedford to fill the German Emperor with envy. It was also pointed out, in reply to the Mayor's argument as to the increased cost of coal and labour, that the cost of generation was now less than formerly owing to the use of more modern plant. The question was raised of following the example of other towns of having a coal clause making an increase of 0'1d. per unit for every 6d. increase in the price of fuel, but the Town Clerk expressed the opinion that this was not admissible unless it was in the tariff for every consumer.

The amendment was ultimately lost by eight votes to ten; a further amendment that an outside expert should be called in was also defeated, and the report was then adopted.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Electric Wiremen's Work. By J. H. Havelock. 332 pp. 7*1*/₂ in. by 5 in. 100 figures. (London: Crosby Lockwood & Son.) 5s. net; abroad, 5s. 6d.

The author of this book is the head of the electrical engineering department of a technical institute, and, it must therefore be presumed, possesses both knowledge and experience in teaching. Yet we are not satisfied that the somewhat unconventional methods employed in the volume before us to teach electrical wiremen their work are the most suitable ones. Before the second page is passed, the electric wireman will find himself floundering in a quagmire of C.G.S. units—dynes, ergs, and joules; on pp. 8 and 9 he is introduced to inductance, impedance, and electric resonance, with the relevant algebraical formulæ; and within the next dozen pages he has specific resistances in microhms and temperature coefficients; on p. 183 he is told that it is futile to attempt to solder with an improperly tinned iron, and that it is sheer waste of time to keep pouring molten metal on a dirty joint, and seeing it run off like water from a duck's back; and finally, on p. 185, he is given a collection of carefully labelled pictures, which include a hacksaw, two screwdrivers, a pair of scissors, and a rubber glove. The appendices will enable the electric wireman to ascertain, incidentally, the modulus of elasticity of aluminium, the specific resistances at 0° C. and the temperature coefficients of platinum, tantalum, and distilled water, and, "by kind permission," the Wiring Rules of the Institution of Electrical Engineers, and four-figure logarithms, anti-logarithms, chords, sines, tangents, cotangents, and cosines. But perhaps the title is apt after all. To appreciate the book will be work, and very difficult work indeed, for electric wiremen.

Company Law and Practice. By H. W. Jordan. 454 pp. 8*1*/₂ in. by 6*1*/₂ in. (London: Jordan & Sons, Ltd.) 12th Edition. 3s. 6d. net; by post, 3s. 1d.; abroad, 4s. 3d.

The author has arranged, in a convenient form for reference, the requirements of the Companies Acts and other Statutes affecting companies, so that the work forms a compendium of company practice covering a wide range. The present edition has been revised so as to include the requirements of the "Trading with the Enemy" legislation and the restriction of the Treasury on the issue of new capital.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,439.

What special precautions are needed in the design of porcelain bobbins for winding resistance wire for heating purposes and winding the wire thereon, and what current density can safely be used?

(Answers must be received not later than first post Thursday, April 29th.)

ANSWERS TO No. 1,437.

Acceptance tests of generators at works are often made by taking only copper and iron losses. Are these a reliable criterion of the operation of the machines at full load, particularly with regard to sparking?—"T. G."

The first award (10s.) is made to "AGATE" for the following reply:—

The question is not very clear, but "T. G." apparently refers to the case of large generators which cannot be put on full load at the works on account of lack of sufficient power supply, or through not having a prime-mover of sufficient capacity. In such cases it is usual to carry out what is known as the "short-circuit" test, and also to measure the power taken by the machine when running light as a motor.

The "short-circuit" test is as follows:—The connections of the series winding (if any) are reversed, so that the magnetic effect of the series winding will oppose that of the shunt winding. This is done so as to get as nearly full excitation as possible on the shunt coils, and hence to get a fair indication of their temperature rise. The brushes are next short-circuited through an ammeter range and the machine started up by some form of drive. The shunt excitation is regulated to give full-load current through the armature when the machine is running at correct speed. This test gives an indication of the temperature rise of the machine in all its parts. Also, since the sparking properties of a machine depend upon the reactance voltage, which is proportional to the current in the armature, the sparking during the short-circuit test is a fairly reliable indication of the sparking under working conditions, although during this test the machine is giving full-load current with perhaps not more than 4 or 5 volts across the brushes.

The power taken by the machine when running light as a motor gives directly the iron, windage, and friction losses. If these losses are required to be known for various voltages they may be found by measuring the power taken by the machine when running light as a motor at different voltages, the shunt field being adjusted to give constant speed.

We have, therefore, a reliable indication of what the sparking and temperature rises will be at full load from the "short-circuit" test, while the losses due to iron-hysteresis, &c., and to friction and windage are found direct from the "light" run as a motor. The copper losses can be calculated from resistance measurements and the full-load current. Thus we have the total losses in the machine at full load from which the efficiency can be calculated. It should, perhaps, be noted, however, that the iron loss at full load will be slightly greater than at no load (as found by "light" run), owing to the distorting effect of the field due to the armature current on the main field. This causes a greater flux density in the teeth and in the edges of the pole-shoes, thus causing a slightly greater iron loss.

The second award (5s.) is given to "A. R. T. C." who writes as follows:—

Acceptance tests of machines, so far as efficiency is concerned, are usually carried out by measurement of the losses, for the simple reason that much greater accuracy is possible than with the input-output method, and also the tests are easily and cheaply carried out, which in the case of large machines is an important consideration. Considering a D.C. generator, the following tests are required for determining the efficiency:—(1) Resistance measurement; (2) iron loss; (3) friction and windage. The methods by which these losses are obtained are well known and need not be described. The efficiency at any output is then equal to the ratio of the output to the sum of the output and the losses at that output. The efficiency obtained is somewhat lower than the true efficiency, as in actual service there are small additional losses, such as circulating currents in the armature coils and brushes, and eddy currents in the iron of the armature. It is impossible to make any definite allowance for these, since they may vary, due to one cause or another, as, for instance, a slight change in brush position. However, these additional losses will certainly not affect the full-load efficiency by more than 0·5 per cent. Regarding commutation, it is usual to carry out a temperature run with full field and no current in the armature, and also with the armature short-circuited through an ammeter and a small field sufficient to cause full-load current to flow through the armature. The temperature rises after six hours' run are measured, and a fair idea obtained of the performance of the machine under normal working conditions. The short-circuited test is not usually carried out on non-interpole machines, as they cannot commute full-load current satisfactorily. With interpole machines, however, the commutation observed gives a good idea of what may be expected in service, but this test should not be taken as superseding a full-load test.

QUESTION No. 1,436.

The author of this question writes us as follows:—How to discover whether a winding is star or delta connected is by no means so simple as "M. M." seems to think. The solution which "M. M." gives is surely in error, for application of the method he proposes to the simple case of a two-pole ring winding, each phase covering two-thirds of a pole pitch, shows that polarity will be produced as well by the star as by the delta winding. It seems to me probable that "M. M." in thinking the matter out, has confused the beginnings and the ends of the phases. I know of only one method which is quite general, and it is practically a very imperfect one, tedious and difficult to apply. It is this: Surround the armature circumferentially with one or more turns of cable and pass through these turns alternating current. If the armature is delta connected an alternating current will be induced in it by transformer action, the applied turns forming the primary and the whole armature forming a single-turn secondary. Unfortunately, the transformer so formed is somewhat "loosely coupled" and the induced current difficult to detect. Theoretically it should be possible to detect it by the heat produced. Such a current would not, ordinarily, produce any difference of potential at the slip rings or terminals of the three-phase winding. Should the winding be star connected there will, of course, be no circulating current produced. Though the general solution of the problem is difficult, each case that occurs in practice can usually be solved either by inspection of the winding or by some simple method applicable to the particular type of winding.

Institution of Electrical Engineers.—The following is the result of the ballot for new members at the meeting on Thursday:—
Members.—J. Cook, Lt.-Col. E. H. Leaf, R.E. (T.), E. W. Monkhouse. **Associate Members.**—W. Dundas, C. V. Peake, A. L. Tackley. **Graduates.**—R. G. Campbell, A. F. Carter, F. W. Highfield, H. R. Lamb, B. McCormick, R. E. Owen, G. A. Sloan, A. Winks. **As Students.**—H. J. Boyland, E. D. Chapman, C. V. Clarke, K. Davidson, A. T. de Paiva, C. Derry, E. L. Glew, H. J. Greenwood, H. J. Hall, L. W. Hayes, F. E. Hunt, E. Lerpiniere, W. F. Lloyd, P. D. Morgan, C. V. Narasingarao, B. H. O'Brien, A. C. Pallot, D. E. Pledge, D. A. Rankin, D. Ripley, V. Ross, E. S. Russell, R. L. Smith-Rose, J. B. Snell, H. T. Stafford-Ball, F. L. Standage, H. A. Whistler.

CANDIDATES TRANSFERRED.—**Associate Member to Member.**—H. Aldum, P. A. Paris, J. W. Spark, T. Wadsworth. **Graduate to Associate Member.**—E. J. Bennett, H. J. Loughlin, C. H. Woodward. **Student to Associate Member.**—H. Clausen, F. F. Elliott, W. B. Garrett, E. Hughes, N. J. Perryman, L. Roberts, G. O. Scampton. **Student to Graduate.**—V. A. Bright, F. J. Delves, C. F. Goodale, S. Willis.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 15th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

29,622/13. Resistances. J. COLLINSON. Grid resistances in which the grids are made of sheet metal which has been passed through a press or rolls such as are used for the manufacture of "expanded" metal, but which has not been expanded. (Three figures.)

4,017/14. Heaters. J. R. QUAIN. The heating element consists of a flat casing of silica containing a metal filament wound zig-zag round a series of pegs formed in the silica base of the casing, and lying in grooves therein. The flat top is fused on hermetically, and the case is exhausted or filled with an inert gas. (Two figures.)

8,134/14. Loading Telephone Lines. H. B. M. PLEIJEL and A. H. OLSSON. Method of arranging "Pupin" coils on duplexed double telephone lines with the coils in the current lines so constructed that the current of the duplex connections produces in them stray fields which serve to load the main line as branches of the duplex lines, whereby, with the same set of coils, the double lines are loaded as main lines and as a branch of the duplex lines. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. CO., CLOUGH and WHITCHER [Protection of alternators] 8,173/14.

Heating and Cooking: QUAIN [Heaters] 4,941/14; WEAVING, SMITH and FERRANTI, LTD. [Heaters] 17,945/14.

Incandescent Lamps: LANGMUIR [Incandescent lamps] 17,326/14.

Switchgear, Fuses and Fittings: ELLISON and MUELLER [Protective devices for motors] 624/14; CAMILLERAAPP [Shock-absorbing lamp holders] 7,644/14; WELLS [Electromagnetic control apparatus] 10,823/14; W. BUTCHER & SONS, LTD., GILL and LIPPOLD [Switches for cinematograph lamps] 17,596/14; SUMNER [Current graduating devices] 18,106/14.

Telephony and Telegraphy: BLONDEL [Location of radio-telegraphic stations] 28,183/13; MARKS [International Quadruplex Co.] [Diplex and quadruplex telegraphy] 2,100/14; BELIN [Time signals] 6,389/14; WESTERN ELECTRIC CO. (Woodward for W. E. Co., U.S.A.) [Automatic Telephones] 13,524/14.

Traction: MOORE and BERRY [Signalling and train-stops] 2,550/14; MIDGLEY and VANDERVELL [Car lighting and engine-starting dynamos] 6,430/14; SAYERS, ACFIELD, SALT and COOKE [Electrically controlled block system] 9,134/14.

Miscellaneous: B.T.-H. CO. and JEWITT [Regulating devices] 8,717/14; HEYES and HEYES [Signalling] 12,721/14; MILLER [Alarm apparatus] 24,780/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: BRITISH WESTINGHOUSE ELECT. & MFG. CO. [DYNAMOS] 4,560/15.

Ignition: R. BOSCH [Connections] 10,478/15.

Telephony and Telegraphy: ELEKTROTECHNISCHE SPEZIAL KONSTRUKTIONEN G.m.b.H. [Thermic telephones] 4,353/15; SMITH [Telephone systems] 4,582/15.

Miscellaneous: MARELLI [Electric machines] 20,784/14.

The following Amended Specifications can now be obtained:—

DYNAMOS, MOTORS, &c.: B.T.-H. CO. and R. S. GIVEN [Motor control] 14,524/13.

Telephony: W.AITKEN [Semi-automatic system] 19,443/13.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

8,478/01. Arc Lamps. A. ECKSTEIN and A. E. ANGOLD. A differential solenoid-controlled cut-out for inserting arc lamp substitutional resistances.

8,648/01. Telephony. W. L. WISE (American Machine Telephone Co., U.S.A.). A complete automatic telephone exchange system.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: P. MÜLLER [Projection arc lamps] 27,251/05.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: W. HEPWORTH COLLINS [Conduits] 28,852/04.

DYNAMOS, MOTORS and TRANSFORMERS: ELECTROMOTORS, LTD., and E. GREENHALGH [Laminated pole pieces] 28,524/08; H. A. MAVOR, H. M. HOBART, and MAVOR & COULSON, LTD. [Multi-speed induction motors with pole-changing device] 30,556/09.

Instruments and Meters: H. H. LAKE (V. Arcioni) [Thermal ammeter] 29,363/04.

Switchgear, Fuses and Fittings: J. GUNNING [Time switches] 29,281/04.

Traction: W. R. SYKES [Signal indicators] 28,829/04; E. M. FITZ [Train-lighting dynamos] 30,333/09.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Directory of Paper Makers of the United Kingdom for 1915. 236 pp. 10 $\frac{1}{2}$ in. by 7 $\frac{1}{4}$ in. (London: Marchant, Singer & Co.) 1s.; by post, 1s. 4d.; abroad, 1s. 8d.

Submarine Vessels, including Mines, Torpedoes, Guns, Steering, Propelling, and Navigating Apparatus. By W. E. DOMMETT. 106 pp. 7 $\frac{1}{2}$ in. by 4 $\frac{1}{4}$ in. 21 figures and 16 plates. (London: Whittaker & Co.) 1s. net; by post, 1s. 2d.

"The War and the Parting of the Ways." By C. H. LUKE. 115 pp. 7 $\frac{1}{2}$ in. by 5 in. (London: Sampson Low, Marston & Co., Ltd.) 1s. net; by post, 1s. 2d.

"Electrical Instruments in Theory and Practice." By W. H. F. MURDOCH and U. A. OSCHWALD. 336 pp. 7 $\frac{1}{2}$ in. by 5 in. 164 figures. (London: Whittaker & Co.) 10s. 6d. net; abroad, 11s.

"Company Law and Practice." By H. W. JORDAN. 454 pp. 8 $\frac{1}{2}$ in. by 6 $\frac{1}{2}$ in. (London: Jordan & Sons, Ltd.) 12th edition. 3s. 6d. net; by post, 3s. 11d.; abroad, 4s. 3d.

"Electrical Engineering." By T. C. BAILLIE. Vol. I., Introductory. 236 pp. 9 in. by 5 $\frac{1}{2}$ in. 131 figures. (Cambridge: The University Press.) 5s. net; abroad, 5s. 5d.

"Key to the London Telephone Directory and Business and Trades' Directory." 131 pp. 11 in. by 7 $\frac{1}{2}$ in. (London: Stone and Colquhoun.) Vol. II., No. 1. January-July, 1915. 2s. net; by post, 2s. 2d.

The War and the Parting of the Ways.—This is the title of a little work, in which Mr. C. H. Luke has brought together some thoughts on the future of the British Empire in relation to the war. He has very little good to say of his country in its present state, and urges that to obtain the utmost possible prosperity after the war considerable reorganisation, industrial, military, and political, is essential. His remarks on the industrial situation are suggestive and interesting, and he points out the great need for a more efficient consular service, further extension of the activities of the Board of Trade, and in general more Government encouragement of industry. He has some hard words to say against British banking methods, and puts in a plea for the establishment of a Bank of Commerce under Government control. Labour, too, he would like to see controlled by a separate Ministry. In military matters he is wholeheartedly in favour of Universal Service, and in politics he bewails the acrimony of party strife. The work, with its pessimistic view of the past and present, would be depressing were it not for the author's buoyant hope in the possibility of the Empire's reform according to his own ideas.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Mr. Charles Bright, F.R.S.E., in an article in the *Nineteenth Century*, deals with various aspects of telegraphy in war-time. He points out the far-reaching effect of the telegraphic isolation of Germany through the cutting of the Channel cables at the beginning of the war, and gives very interesting accounts of the German attack on Fanning Island, where the Pacific cable was cut, and the raid of the *Emden* on Keeling Cocos Island, which, although successful in causing a temporary isolation, led to her own undoing. He discussed the effect on telegraph traffic of the banning of code messages of the Censor, and regrets the lack of central control of cable-working. In the latter part of the article Mr. Bright reiterates his arguments in favour of a State-owned British Atlantic cable, and expresses his regret that the present Atlantic cable system should be under American control. All these arguments have additional force now that we are in a state of war. He also throws some interesting sidelights on wireless in war-time, dwelling on its advantages in effecting communication at sea, and its disadvantages in the possibilities of receiving false messages and the use of hidden transmitting stations by enemy spies. He attributes Admiral Cradock's reverse to "jamming" of his orders to

his ships by the enemy, and finally brands wireless telegraphy as a "very two-edged" weapon, which does not at present serve as a suitable substitute for cable telegraphy wherever the latter is available.

ELECTRIC TRACTION NOTES

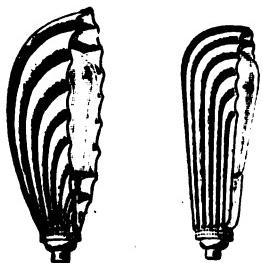
According to the *Electric Railway Journal* (New York), the shortage of horses and carmen in Vienna due to the war has introduced difficulties in the delivery of coal and other goods which are being met by employing the electric trams to tow trains of vans in the streets. Owing to the slow speed necessary these trains cannot be run during the ordinary service, and are only worked at night. The cars used for this purpose are provided with extra heavy resistances, and haul loads up to nine tons of coal at a speed of about 3·7 miles per hour.

A "late" Bill has been deposited in Parliament, called the "Railway Companies Facilities" Bill, the object of which is to authorise the City & South London, Central London, London Electric, and Metropolitan District Railway Companies to enter into agreements as to interchange of traffic, the formation of a common fund for making good deficiencies in the revenue of any of the companies, and the appointment of a joint committee to deal with any agreements which may be made.

"ELECTRICAL ENGINEERING" TRADE SECTION

SHOP WINDOW LIGHTING

A COMPLETE new series of seven styles of shop-window reflectors, all re-designed on scientific lines, has just been brought out by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), consisting of the patterns illustrated here. All of these (except the hemispherical) are made in two sizes, the smaller designed for Osram lamps up to the 30 watts, and the larger for lamps up to the 60 watts, thus ensuring any pear-shaped Osram lamp of the usual sizes having its correct reflector. These reflectors are much more efficient than their less carefully designed predecessors, and in addition to having scientific contours, they effectively screen the light from the eyes of persons looking in the



Shell.



Fluted Scoop.



Plain Scoop.



Hemispherical.



Horizontal Parabolic.



Vertical Parabolic.



Conic.

VARIOUS PATTERNS OF REFLECTORS FOR SHOP WINDOW LIGHTING.

shop-window, so desirable at all times, and necessary at the present time to comply with the police regulations. Special care has been taken to see that the shade-carrier ring, which holds the reflector in position, is easily accessible. Another important feature in the case of the deep conic and vertical parabolic patterns is the provision for the necessary ventilation. The finish is of high-class nickel plating, which assures the maximum amount of reflection being obtained, and owing to the correct form of the surface the light is projected in a manner which turns every ray to advantage. A neat folder, giving particulars and illustrations of these reflectors in tabulated form, together with a table of Osram lamp prices, will be sent on application by the Company's Illuminating Engineering Department, which may be freely consulted on all shop illumination matters.

generating set for supplying current for electric welding work, consisting of a four-cylinder vertical paraffin engine directly coupled to one of their "Castle" continuous-current dynamos specially wound for the work, on one bed-plate, with the necessary tanks, water-cooler, switchgear, and instruments. Particulars are given in a leaflet just issued.

METERS.—A collection of leaflets from Ferranti, Ltd. (Central House, Kingsway, W.C.), contain particulars of a number of patterns of Ferranti continuous-current ampere-hour meters for house service. These are of the mercury meter type with combined permanent driving and braking magnets, and are made in the two-wire ordinary and prepayment patterns, as well as in the form of two-rate meters and three-wire meters. A full series of spare parts is listed. Another leaflet describes the Ferranti continuous-current watt-hour meter for house service, also of the mercury type, but with shunt-wound driving magnet and permanent braking magnets.

FANS AND AIRCRAFT

A NEW folding leaflet from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), gives the excellent piece of advice: Keep cool in case of a heat-wave; and supplies particulars of their "Freezer" fans enabling this to be done.

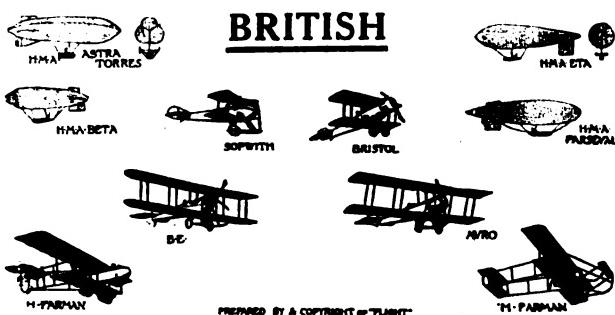
GERMAN & BRITISH AIRCRAFT

How to distinguish between the two.



The Zeppelin and Schütte-Lanz airships are very long; it should be noted that the former has three cars, the one in the centre being in the keel, while the Schütte-Lanz has five cars, two in the centre being arranged side by side. The M type has not only a distinctive shape, but the cars are joined to the gasbag by fabric.

The Taube is recognised by its bird shaped wings. Several of the biplanes cannot easily be distinguished from British or French machines. Some however, have the wings sloped back. The German aeroplanes have an "Iron Cross" painted below the wings and each side of the rudder.



PREPARED BY A COMMITTEE OF FLIGHT.

The Astra-Torres can be recognised by the trefoil shape when she is seen end on. The Beta has a peculiar car which tapers towards the rear, while the car of the Beta is more torpedo shaped. The Parasol is similar to the German Parcav. British aeroplanes fly the white ensign attached to their rudders.

The B.E. can be distinguished by the large curve at the rear edge at the ends of the planes. The British and Sopwith scouts are small. The Farnham have the propeller at the rear edge of the front planes. The British machines have a Union Jack painted below the planes while the French ones have a rosette of red, white and blue.

Folder No. 7, 1915.
Price, 1/-

On the other side is the equally good advice, "Keep cool in case of an air raid, and the information reproduced here on German and British aircraft is given inside. Copies of the leaflet can be overprinted with contractors' names and addresses.

INDIRECT LIGHTING AT SELFRIDGE'S

THE new annexe of Selfridge's, consisting of the provision department, is lighted entirely with half-watt lamps, and



FIG. 1.—SELFRIDGE & CO., LTD., OXFORD STREET, W. ARTIFICIAL LIGHT PHOTOGRAPH OF CORNER OF PROVISION DEPT., GROUND FLOOR, B.T.-H. "EYE-REST" SYSTEM OF INDIRECT LIGHTING WITH HALF-WATT LAMPS.

after a considerable amount of experiment with different methods of employing these lamps it was decided that the British Thomson-Houston Co.'s well-known "Eye-rest" system of indirect lighting met the case best from all points of view. On account of their brilliancy, half-watt lamps are particularly suitable to this form of lighting. This system was accordingly installed on the ground floor and first floor of this large block of buildings. The fine effect is shown in Figs. 1 and 2, and one of the fittings used is illustrated in Fig. 3. Each bowl is, of course, fitted with a special "X-ray" reflector in the correct focal position with the half-watt



FIG. 2.—SELFRIDGE & CO., LTD., OXFORD STREET, W. ARTIFICIAL LIGHT PHOTOGRAPH OF CORNER OF GROCERY DEPT., FIRST FLOOR. B.T.-H. "EYE-REST" SYSTEM OF INDIRECT LIGHTING WITH HALF-WATT LAMPS.

filament, which redirects the light on to the ceiling, whence it is distributed over the shop. In the basement semi-indirect lighting, also with half-watt lamps, is employed, and the B.T.-H. Co.'s "Lumina" fitting is used. One of these fittings is illustrated in Fig. 4. This lighting scheme is one of the finest examples of well-arranged shop lighting that can be seen, and shows that, when properly applied, half-watt lighting can excel as much in beauty as it can in economy.

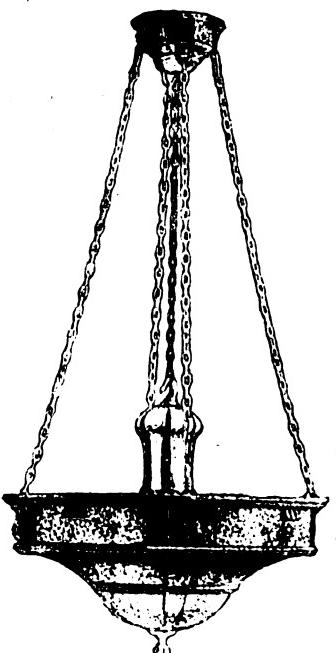


FIG. 3.—B.T.H. "EYE-REST" FITTING AS USED IN PROVISION DEPT.

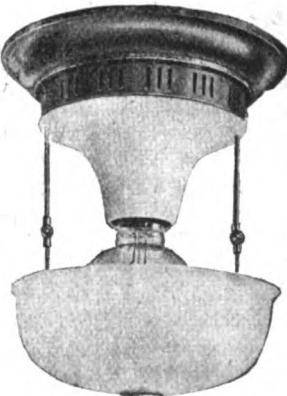
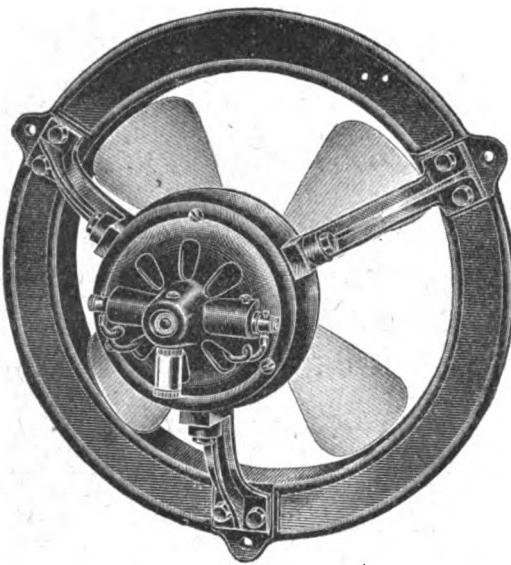


FIG. 4.—B.T.H. "LUMINA" FITTING AS USED IN MARBLE MARKET.

The whole installation reflects great credit upon all concerned, including Mr. H. J. Clarke, who is in charge of Selfridge's Building Department; Messrs. Rashleigh, Phipps & Co., the contractors; and the Illuminating Engineering Department of the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.).

Working 24 hours a day.



SUN VENTILATING FANS are made in a number of sizes, moving up to 20,000 cubic feet of air a minute.

In order to ensure a good and clear atmosphere in factories working two and three shifts a day, adequate ventilation is essential. Otherwise the workers are bound to be slack, and unable to put forward their best efforts.

There are many such factories in your district. Why not sell them

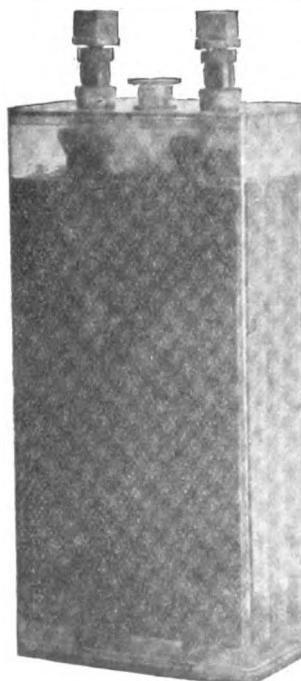
SUN FANS ?

:: Post the enquiry NOW to ::

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THE **NAYLOR BATTERY CO., LTD.**

Traction
Lighting
Car Starting
Railway
Lighting, etc.



These batteries can be charged at rapid rate without injury to the plates

Phone—Streatham 1317

LAMMERMOOR ROAD, BALHAM, LONDON, S.W.

A NEW HEATING AND VENTILATING SYSTEM

A SYSTEM of combined heating and ventilating has been introduced by Credenda Conduits, Ltd. (Chester Street, Aston, Birmingham), and the first installation to be made in London of the apparatus is at work at the show-rooms of Baxter & Caunter, Ltd. (219 Tottenham Court Road). A combined heater and fan is situated in the basement. Air is drawn in by an electrically-driven centrifugal fan in quantity sufficient to change the 16,000 cu. ft. of air in the show-room, staircase, and corridors twice per hour through a drum-shaped heater, 24 in. long by 16½ in. diameter, attached to the body of the fan containing heating elements, consisting of resistance wire, heated to a dull glow, wound on porcelain bobbins. The heated air is passed up a well-lagged trunk with branches to outlets in the floor of the show-room. Three switches are provided, by which five degrees of heat can be obtained, with a maximum consumption of 10 kw. and a minimum of 2 kw. The case is in many ways an unfavourable one for this form of heating. Not only does much of the heated air escape up the stairs, but the frequent opening of the front and other doors causes a considerable cooling effect. It is surprising, however, in face of these disadvantages, how quickly the show-room heats up and how little energy is required to keep a comfortable temperature, owing to the excellent circulation of air which characterises the system. In a careful test under ordinary working conditions, with the outside air at 48° F., the full temperature of 58·7° F. was attained in less than an hour and ten minutes with the full consumption of 10 kw., and to keep up that temperature only 4 kw. was required, considerably less than would have had to be expended in ordinary radiators. In slightly warmer weather 2 kw. is amply sufficient. The apparatus has displaced two large fires and a 1-kw. radiator, but gives a higher average and much more even temperature. The system is here seen in its simplest form. It can, of course, be combined with any form of air-filter, and, if desired, automatic thermostatic control can be employed to keep the temperature constant instead of switching off the larger heating elements by hand when the required heat is obtained. Again, there is no reason why the heater and the fan should be in the same place. In large installations it will often be more convenient to have a single fan in the basement supplying one or more rising main trunks, and to put separate heaters in the branches on each floor, so that the heating of the various parts of the building can be adjusted separately.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Bolton.—An inquiry is to be held concerning a loan of £45,000 for electrical extensions.

Carnarvon.—A loan of £500 for mains is to be applied for.

Clacton.—A loan of £1,300 for a battery at the power station has been applied for.

Cuba.—An issue of the *Gaceta Oficial* (Havana), on file at 73 Basinghall Street, E.C., contains particulars of certain electric lighting concessions in Cuba.

Kingstown.—Mr. J. P. Tierney has been appointed Consulting Engineer for the Council's electric lighting scheme.

New Zealand.—The date for receiving tenders for a three-unit exciter set and a 1,500-kw. generator for the Lake Coleridge power scheme has been extended to May 21st. Firms with agents in Australia or New Zealand have only time to cable instructions.

Stretford.—Mains extensions at an estimated cost of £935 are to be carried out.

Waterford.—A L.G.B. inquiry is to be held into the Council's £30,000 electric supply scheme.

West Hartlepool.—Application is to be made for sanction to a loan for mains and services and for water-softening apparatus.

Wiring

Newport (Mon.).—Rearrangement of electrical installation, St. Mark's Church. Borough Electrical Engineer.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Dundee.—New City Hall.

Kilmarnock.—Lighting of workhouse. Clerk.

Middlesbrough.—School, Grove Hill.

Plymouth.—Extensions to technical school buildings (£17,000).

Wigan.—Cinematograph theatre. Eagle Picturedrome Co.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Wolverhampton.—The tender of Messrs. Mossay & Co. has been accepted at £630 for a 2½-ton Orwell electric vehicle for the removal of ashes from the generating station. The cost is to be met out of reserve.

Mr. J. H. Tucker & Co. have recently received contracts for annual supplies of service fuse-boxes from the Bolton and Blackburn Corporations and the Ilford District Council; for lamp-holders from the Swindon Corporation; for ironclad switches from the Dundalk District Council; and lamp-holders, switches, &c., from the Halifax Tramways Department.

Messrs. Venner & Co. have received contracts for twelve months' supply of Chamberlain & Hookham meters for Kirkcaldy, West Hartlepool, Swindon, and Pontypridd.

Contracts have been placed by the Swindon and West Hartlepool Corporations with the Bastian Meter Co. for 3- to 10-ampere meters and 2½- to 5-ampere meters respectively.

The British Westinghouse Co. have recently been favoured with contracts from the following supply authorities for single-phase alternating-current house-service watt-hour meters:—Bath, Blackburn, Bristol, Croydon, Eccles, Ipswich, Leeds, and West Ham Corporations, and the Beckenham, Rhondda, and Watford District Councils.

APPOINTMENTS AND PERSONAL NOTES

Mr. M. Barrington Baker has completed his contract with the Crown Agents for the Colonies in Zanzibar, and is now proceeding to Hong Kong as Chief Assistant Engineer to the China Light & Power Co., Ltd.

Mr. W. E. Pott, late General Manager to Messrs. Krupka & Jacoby, has been appointed manager of the electric novelty department of J. S. Hind & Co. (6 Eldon Street, E.C.), representing the Interstate Electric Novelty Co. of America.

Mr. W. T. Robson, Manager of the South Shields Corporation Tramways, has been appointed to a similar position at Southampton. The latter post was rendered vacant in order to allow Mr. H. F. Street to devote all his time to the Electricity Department.

Wiremen are required by John Brown & Co. (See an advertisement on another page.)

A materials superintendent and clerk is required in the St. Helens Electricity Department. (See an advertisement on another page.)



MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £81 10s. to £82 10s. (last week, £78 10s. to £79 10s.).

Liquidations.—A meeting of Metalite, Ltd., will be held at the offices of Messrs. Vincent & Goodrich, 9 and 10 Pancras Lane, E.C., on May 20th, at 10.30 a.m., to hear the liquidator's account of the winding-up.

May 4th is the last day for receiving proofs in the liquidation of the Consolidated Diesel Engine Manufacturers, Ltd. Sir William Peat, liquidator, 11 Ironmonger Lane, E.C.

Half-Watt Lamps.—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), announce that for the future Osram half-watt lamps will be known by the name of Osram Atmos type lamps.

LOCAL NOTES

Arbroath: Street Lighting Tests.—The Gas Committee is to demonstrate the use of gas for street lighting in competition with the local electricity company. At present all the streets are lighted electrically.

Belfast: Electricity Staff Reorganisation.—The Corporation has considered, in Committee, the difficulties attending the proposed reorganisation scheme referred to in our last issue. According to the local papers, the matter has been again referred to the Electricity Committee to deal with.

Dublin: Electricity Works Reorganisation.—Councillor Sherlock proposes to ask the Corporation to appoint a Special Committee to inquire into a report upon the administration of the electricity undertaking; the prices charged for light and power; the number of engineers and workmen employed and paid out of revenue; the salaries and wages paid out of revenue; the procedure adopted with regard to purchasing coal; charge for interest and repayment of moneys borrowed.

Dundee: Depleted Electricity Staff.—The Electricity Committee has communicated with the War Office regarding further enlistments from their staff. Owing to the fact that already seventy-two men have gone to the colours, great difficulty is being experienced in maintaining the supply to foundries and jute establishments now engaged on important military contracts.

Ealing: Staff Enlistments.—Owing to the serious effect upon the working of the electricity undertaking which the number of men enlisting is having, the Council has decided to suspend, so far as the electricity works staff is concerned, the resolution to pay salaries or wages less army pay.

Edinburgh: Coal Costs.—In arranging its coal contracts for the coming year, the Electricity Committee reports that the total cost will be about £10,000 more than last year.

Liverpool: Annual Accounts.—The electricity accounts for the year to March 31st show a gross profit of £189,977, to which is added interest amounting to £399. After meeting capital charges and allocating £43,217 to renewals fund, the balance of £25,000 is transferred to relief of rates.

London: Marylebone: Postponed Works.—In view of the necessity for obtaining the Treasury sanction to new capital expenditure, the Electricity Committee has decided to hold over a scheme of installing trunk feeder protection apparatus. It was estimated to cost £6,500.

Manchester: Electricity Repair Shops and Munitions.—The Electricity Committee has offered the War Office the repair shops at Stuart Street generating station, which, it is said, has an up-to-date equipment capable of dealing with the manufacture of shells.

Barton Power Station.—So far the Treasury has not yet replied to the petitions of the Finance and Electricity Committees with regard to allowing the Barton power station scheme to go forward.

Newcastle-under-Lyme: Contract Cancelled.—Owing to the refusal of the L.G.B. to sanction a loan of £1,250 for cable, a contract provisional entered into with Callender's Cable & Construction Co. at £1,240 4s. has been cancelled.

Newport (Mon.): Increased Charges.—The recommendation of the Electricity Committee, mentioned in our last issue, to increase the charge for electricity supply by 20 per cent. led to a long discussion at the meeting of the Corporation last week. Several members urged that the increase was too large, and that the actual extra cost to which the Committee is now put does not exceed 10 per cent. Eventually, however, the increase was sanctioned.

Rhyl: Plant Extensions.—An expenditure of £2,500 has been incurred upon new plant to supply the Kinmel military camp with electricity. The War Office is bearing the whole cost of the plant.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Vickers.—A final dividend, making 12½ per cent. on the ordinary shares, is recommended, carrying forward £228,000. General reserve is previously credited with £250,000.

Babcock & Wilcox.—A dividend of 9 per cent. is recommended on the ordinary shares for the second half of 1914 (5 per cent. was paid for the first half of the year), and after placing £150,000 to reserve and £10,000 to staff pension fund, a balance of £69,500 is carried forward.

Shropshire Power Co.—The capital of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. is to be converted from £5 shares into 900,000 ordinary £1 shares, whilst the unissued 150,000 ordinary £1 shares are to be converted into 6 per cent. cumulative preference shares. Powers are also taken to borrow £100,000 on mortgage.

NEW COMPANY

NEWTON BROS. (DERBY). 21 Market Place, Derby. Capital £31,000. To take over the existing business of electrical and mechanical engineers carried on by C. A., R., and H. Newton.

Crystal Palace School of Practical Engineering.—The taking over of the Crystal Palace by the Admiralty has in no way interfered with the activities of this school. A new course commences on Wednesday next. New students should attend on the previous day between 10 and 1.

—OUR BOOK— DEPARTMENT.

Technical Books by all Publishers sent carriage free to any address in the United Kingdom at net published prices.

Orders should be addressed to the KILOWATT PUBLISHING CO., LTD. (Publishers of *Electrical Engineering*), 203, Temple Chambers, London, E.C., and should be accompanied by a remittance.

List of recommended electrical books on application.

ELECTRICAL ENGINEERING

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(Established 1884)

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SUMMARY

CONSIDERABLE progress is being made with the Electrical Emergency Service, and readers in London are invited to enrol, particularly those of over military age, who are willing to give four hours of their spare time daily so as to release younger men for military service. Further particulars will be found on p. 182.

A PAPER by Mr. A. Dickinson read before the Manchester Local Section of the Institution of Electrical Engineers on Tuesday described the water-power 100,000-volt transmission scheme of the Tata Hydro-electric Power Supply Co., Bombay. The Paper will be discussed at the London meeting of the Institution to-night (p. 183).

THE Yorkshire Electric Power Co.'s Bill, which sought electric lighting powers in some sixty-four local districts at present in the power supply area, was rejected, somewhat summarily, by a House of Lords Committee on Monday (p. 184).

AN appeal is made for recruits for the Royal Engineers, including men with electrical experience (p. 184).

THE Highways Committee of the L.C.C. has accepted the tender of the British Westinghouse Co. for two 8,000 kw. turbo-generators for Greenwich. Two firms tendered at lower prices, and the reasons for rejecting these tenders are given (p. 185).

SOME technical books are reviewed in this issue (p. 185).

AMONG the specifications published at the Patent Office last Thursday was one by Dr. I. Langmuir for

introducing mercury vapour into the bulb of gas-filled metal filament lamps to prevent volatilisation of the filament. Other subjects dealt with are renewable incandescent lamps, motor control, generator protection, and electric heaters. Two decisions of the Comptroller regarding opposition to applications of C. O. Bastian relating to helical filament lamps (p. 186).

At the Wireless Society of London last week, Prof. E. W. Marchant lectured on the question of the accurate measurement of wireless signals (p. 186).

THE measurement of the resistance of a fuse electrolyte is discussed in our "Questions and Answers" columns (p. 187).

AN electrically driven cloth printing machine is illustrated (p. 188).

A CRITICAL notice of the new number of the *B.E.A.M.A. Journal* appears on p. 188.

A NEW series of loan repayment periods for tramway capital has been adopted by the L.C.C., subject to the approval of the Treasury (p. 188).

AN expenditure of £8,500 is contemplated at Aldershot; a 1,000 kw. turbo-alternator is required at Dover; new plant and mains at Barnsley; transformers and converting plant at Mansfield; and converting plant and sub-station equipment at Bolton.—Cable, water-tube boilers, and car meters are required in Australia, and circuit breakers in Johannesburg (p. 189).

TWO-THIRDS of the pressure testing stations required by the L.C.C. have been erected.—The Manchester Electricity Department proposes to contribute £30,000 to relief of rates.—Coal has been discovered on the site of the new Bury power station (p. 190).

Engineer Volunteer Training Corps.—The replies received to the circular recently issued by the Institution of Electrical Engineers to the members residing in the London district have been communicated to the Central Association of Volunteer Training Corps, whose Engineering Adviser is of opinion that the response received is sufficient for the matter to be proceeded with. Enrolment forms have accordingly been sent to all those who have expressed willingness (conditional or unconditional) to join the proposed Corps. Further enrolment forms for members whose residence or occupation is in the London district can be obtained at the Institution of Electrical Engineers, Victoria Embankment, W.C.

Arrangements for the Week.—(To-day) Thursday, April 29th.—Institution of Electrical Engineers. "The Bombay Hydro-Electric Scheme," by A. Dickinson. 8 p.m.

Saturday, May 1st.—Royal Institution. Lecture I.: "Photo-Electricity," by Prof. J. A. Fleming, F.R.S.

Wednesday, May 5th.—Institution of Electrical Engineers. Students' Section. Annual meeting. Sir John Snell, President, will give an address. 7.45 p.m.

Friday, May 7th.—Junior Institution of Engineers, 39 Victoria Street, S.W. Imperial discussion. 8 p.m.

Royal Institution. Evening discourse. "Electrons and Heat," by Prof. O. W. Richardson. 9 p.m.

Saturday, May 8th.—Afternoon lecture, II.: "Photo-Electricity," by Prof. J. A. Fleming, F.R.S. 3 p.m.

THE ELECTRICAL EMERGENCY SERVICE

HERE has been a good response to our invitation to electrical engineers last week to enrol themselves in the Electrical Emergency Service, and it will be the means of relieving the difficulty with regard to switchboard attendants in some of the electricity works in and around London, and of enabling several of those of military age, who are now kept back, to join the Army. Electrical engineers of all ranks have applied for enrolment as temporary switchboard attendants, but there is room for many more—especially for those of a comparatively high standing in the profession and over military age whose knowledge and experience will enable them to perform the comparatively simple duties with only a few hours' or minutes' explanation of the details of the particular switchboard, station, and sub-station upon which their activities are to be directed. It should be understood that it is not *infra dig.* for such gentlemen to perform these duties at a time of national emergency, any more than it is unseemly for the peaceful householder who has never wielded a truncheon in his life (and whose only use for a whistle hitherto has been to call a cab) to enter the ranks of the Special Constabulary.

No electrical engineer need regret that he is too old to join the Army if he can temporarily take over the duties of another man of military age and enable him to do his duty to the country in the fighting line. When the war is over, every man will want to be able to realise what has been the share he has taken in the great struggle, and his children and grandchildren will want to know too. The man who can say that, although he was too old for the trenches, he yet did his share by modestly filling the place at home of a younger man, can feel that there is much to his credit.

Among those who have applied for enrolment are some men who are at present working as switchboard attendants already, and who are willing to put in four hours' work a day in addition to their present eight hours' daily work. We ask these gentlemen to ascertain first whether their services during the additional four hours would not be accepted by their present employers, and only to apply to us for enrolment and employment in other stations and sub-stations if their employers are satisfied that they should do so.

Owing to geographical considerations (which are of considerable importance when midnight duty is in ques-

tion), and the varying requirements and conditions of the different electricity works, it has not been possible to give immediate effect to all the applications received, but by the time this appears in print several members should have been placed, and several others are being held in readiness to replace further enlistments in Kitchener's Army and in the important industrial army which supplies it with ordnance and ammunition. But although the response has been good during the past week, many more men are still required for the Electrical Emergency Service, and we invite further applications.

THE following Engineers and Managers of electricity works, &c., in Greater London have expressed their approval of the Electrical Emergency Service:—Mr. Sydney W. Baynes (St. Pancras), Mr. A. W. Blake (Willesden), Mr. J. H. Bowden (Poplar), Mr. E. Calvert (Finchley), Mr. A. C. Cramb (Croydon), Mr. C. S. Davidson (Barnes), Mr. A. L. C. Fell (L.C.C. Trams.), Mr. Herbert Jones (Waterloo—City and L. & S.W. Rly.), Mr. G. W. Keats (Woolwich), Mr. J. D. Knight (Ealing), Mr. W. E. J. Heenan (Bermondsey), Mr. G. W. Partridge (London Electric Supply Co.), Mr. G. M. Powell (Smithfield Markets Electric Supply Co.), Mr. L. L. Robinson (Hackney), Mr. E. T. Ruthven-Murray (North Metropolitan Electricity Power Supply Co.), Mr. Roger T. Smith (S.W. Rly.), Mr. C. P. Sparkes (County of London Co.), Mr. H. W. Sprunt (South London Electric Supply Corporation), Mr. G. R. Spurr (Walthamstow), Mr. H. P. Stokes (Bexley), Mr. J. E. Tapper (Beckenham), Mr. W. C. P. Tapper (Stepney), Mr. H. Tomlinson-Lee (Wimbledon).

Applications for enrolment, on the form below, should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

The Service Required.

- A. A full eight-hour shift a day, or—
- B. A half-shift (four hours) daily (1st week morning, 2nd week afternoon, 3rd week night, in rotation).
- C. A half-shift every day, without midnight work.
- D. A half-shift alternate nights with no day work.

To prevent any suggestion of competition with regular employees, wages will be paid in proportion to the existing rates at the works at which the member is employed, and to the time given.

A week's notice will be required from any member leaving the Service.

APPLICATION FORM.

(Please cut out, fill in, and return to the Editor of "Electrical Engineering," 203 Temple Chambers, London, E.C.)

I wish to be enrolled as Member of the Electrical Emergency Service.

Age..... Married or Unmarried.....

Qualifications (state electrical experience)

.....
.....
.....

I am willing to work a full shift as (A) (above),

a half shift as (B), (C), (D).

(Delete the line and letters not applicable.)

My regular occupation prevents me at present from giving electrical emergency service between.....a.m. and.....p.m.

Signature

(Please write very
distinctly, and give
addresses very fully.)

Residential Address

Business Address.....
.....

THE BOMBAY HYDRO-ELECTRIC SCHEME

A PAPER by Mr. A. Dickinson, describing the water-power scheme of the Tata Hydro-electric Power Supply Co., Ltd., which supplies energy to Bombay principally for the driving of cotton mills, was read at the Manchester Local Section of the Institution of Electrical Engineers last Tuesday, and will also be discussed at the London meeting of the Institution to-night. The power station is at Khopali, forty-three miles from Bombay, and special features of the scheme are the large water storage necessary owing to the climatic conditions and the use of a pressure as high as 100,000 volts for transmission. The present capacity of the generating plant is 55,000 h.p., and this will ultimately be increased to 88,000 h.p.

The storage lakes are three in number. The smallest, Lake Lonawla (986 acres, 361 million cu. ft. of water) is intended principally for use during the monsoon period, and when this is empty water is drawn from lakes Walwan (1,535 acres, 2,560 million cu. ft.) and Shirawta (3,174 acres, 6,963 million cu. ft.). These lakes were formed by suitable dams aggregating 17,000 ft., and the outlet of the Shirawta lake is connected to Walwan lake by a tunnel 5,000 ft. long. The design and material of the dams, sluices, &c., are described at some length in the Paper. Water from the lakes is taken by ducts totalling 4·6 miles, with a capacity of 120,000 h.p. at a maximum water velocity of 5 ft. per sec., including several aqueducts and tunnels to the forebay, which has a storage capacity for 1½ hours with the whole of the eight sets working. Openings are provided in the dam for three 82-in. pipes, and the gates for these are worked through racks either by hand or by a 12-h.p. motor, which gives a gate-lifting speed of 13½ in. per min., and can open a gate fully in eight minutes. Special provision is made for closing the gates rapidly from the power-house in case of emergency by a solenoid which releases the ratchet-wheels so that the gates close by their own weight, but are prevented from being damaged by falling too quickly by automatic brakes. The pipe-line from the forebay to the power-house is one of the largest ever built. The top part consists at present of one upper pipe 8,200 ft. in length, a distributing pipe and four lower pipes 4,800 ft. in length. This is half the ultimate equipment. The upper pipe is in three sections, the first two of riveted steel 3/8 in. and 13/16 in. thick, 82½ in. and 76¾ in. in diameter, and the third of lapwelded steel 72 in. diameter and 11/16 in. to 13/16 in. thick. The lower section is all lapwelded steel from 42 to 38 in. diameter and ½ to 1¼ in. thick. The whole pipe-line is laid above ground, is provided with suitable expansion joints, and was supplied by Escher Wyss & Co. (Zurich). The total static head is 1,725 ft., and there is a loss of head of 66 ft. with four turbines running at 11,000 h.p. each.

The power-house is designed for a plant capacity of 88,000 h.p. in eight main sets, two 860-h.p. exciter sets, eight step-up three-phase 10,000-k.v.a. transformer banks, with the necessary switchgear, station auxiliary apparatus, and four outgoing lines. The present building will accommodate five sets and two outgoing lines, and is capable of extension. The main sets consist of Escher-Wyss horizontal shaft impulse turbines running at 300 r.p.m., coupled to Siemens three-phase generators. The exciter sets are driven by tangential wheels running at 600 r.p.m. The governors of the main turbines are of the oil-pressure servo-motor type, controlling the deflecting nozzles, and are guaranteed to limit the speed variation to 2½, 5, and 12 per cent. when 25, 50, and 100 per cent. of the load is thrown off suddenly. The guaranteed full-load efficiency of the main turbines is 82 per cent. and of the exciter turbines 77 per cent.

The main generators are of the totally enclosed type, ventilated by fans on the motor shafts. The air supply is controlled by shutters worked by electric motors, and automatically controlled so that when the field switches are closed the shutters are open and vice versa. Each generator is designed for a full-load normal rating of 8,000 kw. at a power factor of 0·8, and 4,000 to 5,300 volts 50 cycles three-phase with a temperature rise not exceeding 60° F. above air at 110° F., and 20 per cent. overload for ten hours without injury. The full-load efficiency at 0·8 power factor is 94·3 per cent., with an inherent regulation of 9 per cent. at unity and 22 per cent. at 0·8 per cent. power factor. The exciters are rated 600 kw. each. Each main set requires 25 to 38 kw. excitation, according to the power factor.

The transformers are in banks of three single-phase oil-immersed water-cooled units, delta connected, and designed for an output of 3,333 k.v.a. at 0·8 power factor when stepping-up from 5,000 to 100,000 volts, with a water circulation of 950 gallons per hour. The full-load efficiency at 0·8 power factor is 98·1 per cent., and the efficiency at half-

load 97·2 per cent., and the regulation 0·8 per cent. at unity power factor, and 4·6 per cent. at 0·8 power factor. On account of the high voltage, special terminal bushings are used. The high-tension bushings are of the compound-filled type, and consist of a conductor rod from the top to the bottom which is surrounded by several concentric press-board insulating cylinders, separated by spaces, outside which the exterior wall of the bushing is built up of a number of annular rings of moulded insulating compound, interspaced with impregnated press-board discs of larger diameter than the rings in order to prevent leakage. These discs and rings are cemented together, and are tightly clamped by nuts at the top and bottom of the rod. The bushings are supported on cast-iron rings attached to the cover. The low-tension bushings are of porcelain. A special testing set is provided for testing oil with a 0·2 in. spark gap. The oil is filtered until the puncture voltage is raised to 40,000 volts. Very complete arrangements for oil and water supply are provided.

The switchgear is arranged so that each main unit may be run on its own transformer bank or through transfer bus-bars on any other bank. On the H.T. side the transformers and outgoing lines are worked in parallel. The oil switches are arranged in groups of three independent solenoid-operated single-phase switches to work as one switch, with a breaking capacity of 40,000 k.v.a. Reverse time-limit overload releases are provided only on the high-tension side of the transformers. The H.T. connections are copper tubing on post insulators arranged for a phase spacing of 5 ft., and an earth-striking distance of 3 ft. The switchgear permits of sectionalisation of the H.T. bars and a water rheostat-testing circuit, as well as a 200,000-volt testing transformer, is provided for. The whole control is from a marble bench-board, and the switch-gear is worked from a 220-volt 60-ampere 8-hour battery in conjunction with an 18-kw. motor-generator. The generator field rheostats and other auxiliaries are also motor-driven from this battery. The auxiliary switchboard also controls station power and lighting from two 312-k.v.a. 440-volt transformers. A stand-by service for these purposes is supplied by two 80-kw. Diesel engine-driven sets. Both Tirrill and Brown-Boveri voltage regulators are provided to control the pressure on the 100,000-volt bus-bars. Each outgoing line is protected with choke coils and an aluminium-cell lightning-arrester equipment complete with horn gaps, disconnecting switches, a discharge alarm, and discharge recorders. The generators are star-wound for operation with an unearthed neutral, and for protection against pressure-rises are provided with "over-tension" apparatus, consisting of isolating switches, static discharges, and star-delta horn-gap arresters. Earthed bus-bars are run throughout the length of the building, and copper earth-plates are provided for connecting up to the lightning arresters and other apparatus.

The transmission line is 48 miles in length, and crosses two tidal creeks, one 10,000 ft. wide. There will ultimately be four circuits on two lines of towers, with two change-over stations for dividing the line into three sections for cutting out or interconnecting different sections as required. The present installation comprises two circuits on one line of towers, insulated for a working pressure of 100,000 volts between phases. The conductors consist of 7-strand hard-drawn copper, with each wire 0·095 sq. in. section; for creek crossing silicon bronze wires are used. Individual wires of each conductor are drawn in as long lengths as possible, and where joints are used they are silver brazed, the conductors being supplied in standard lengths of 2,200 yards. For joining up on site a twisted sleeve, mechanical joint is used. The conductors are spaced 10 ft. 6 in. apart, and in the case of the intermediate towers are arranged delta fashion on either side of the tower, suspended on 6-unit insulators. In the case of the anchor towers the conductors are arranged vertically on either side of the tower and are suspended on 6-unit insulators. For the creek-crossing towers 7-unit insulators are used, the conductors being arranged vertically over one another on either side. The suspension insulators, which are 10 in. in diameter, are of two types, viz., of the metal hooded type with ball joints for using vertically on intermediate towers, and of the link type for using horizontally on anchor towers.

Three patterns of steel tower are used for ordinary suspension, anchoring, and creek-crossing, and about 500 are used in all. The ordinary towers are 62 ft. high and 500 ft. apart, and the creek-crossing towers are 160 ft. high, 1,175 ft. apart, and are each carried on four concrete-filled caissons. The wires have to be kept 80 ft. clear of the water. A telephone line is carried on the same towers as the power line, and for removing static disturbances in the telephone line, in event of a fault in the power circuit, a special type of "drainage coil" is used. A galvanised steel guard-wire cable is carried over each power circuit. The equipment at the

change-over stations in the line consists of four triple-pole, single-throw, 100,000-volt, bolt-type, out-of-door, disconnecting air-break switches, which are mounted on 7-unit insulators fixed on wooden supports on the towers, and are operated by rods from the ground through bevel gears and rack. Each of the present circuits will transmit a load of 15,000 kilowatts at 0·8 power factor with a regulation of 11 per cent. and a line efficiency of 93 per cent., and a load of 20,000 kilowatts with a regulation of 14 per cent. and a line efficiency of 91·5 per cent.

The receiving station is situated at Parel on the Island of Bombay. It has been designed for an ultimate plant capacity of 74,880 k.v.a. in eight three-phase step-down transformer banks of 9,360 k.v.a. each, and four incoming lines with the necessary switchgear and station auxiliary apparatus, of which five complete units and two incoming lines are now being installed. For improving the power factor and regulation of the system, duplicate synchronous-condenser sets are provided, each consisting of a 6,600-volt, 50-cycle, 500 r.p.m., three-phase synchronous motor with a 125-volt exciter on the overhung part of the shaft. The feeder distribution system from the receiving station to the mills is designed for a 6,600-volt 50-period three-phase supply with an unearthing neutral.

The mills are driven by induction motors on the group-drive principle, controlled by liquid starters, and a sub-station is provided at each mill. The present contract covers thirty firms, requiring 63 transformers aggregating 39,500 k.v.a. and 199 motors aggregating 37,525 h.p. The power requirements of individual mills ranging from three motors aggregating 325 b.h.p. to 19 motors totalling 2,400 b.h.p. The terms of the agreement between the company and the mill-owners cover the supply of energy for power purposes in Bombay at 0·55 anna per unit in the case of mills where the company supply the complete equipment, and at 0·5 anna per unit in the case of mills which provide their own motor equipment, the company providing and maintaining the mill transformers. Energy for lighting is supplied at 1·25 annas per unit. The agreement is for a period of ten years.

YORKSHIRE ELECTRIC POWER BILL

Lighting Powers Refused

THE Yorkshire Electric Power Company's Bill, by which the Company sought powers to supply electricity for lighting purposes in some 64 districts in its area, was rejected by a House of Lords Committee on Monday, without the opposition being called upon to state their case. The Leeds, Sheffield, Rotherham, Huddersfield, Wakefield, Halifax, Bradford, and Barnsley Corporations opposed, in addition to the Brighouse Urban District Council, Great Northern Railway, and ten gas companies.

At present the Power Company is only authorised to supply in bulk and for power purposes, any power consumer being entitled to use 20 per cent. of his total consumption for lighting purposes. The Company's original Act was passed in 1901, and as was done in the case of all the early power companies, the districts of the large municipalities in the proposed area of supply were cut out, but wayleaves had to be granted for the purpose of carrying mains through to other parts of the power area, subject to an appeal to the Board of Trade in case of dispute. The Company regards it as an absurd anomaly, that whereas a power user is able to obtain under the 20 per cent. clause, all the electrical energy required for lighting, his next-door neighbour may be unable to obtain a supply for lighting at all because he does not take a supply for power. Hence it was that last year a proposal was put before all the local authorities in the Company's area for whose districts lighting powers do not exist, that the Company should supply for lighting. The Bill was thrown out on a technical point early in the session, but the application was renewed this year. In order to avoid as much opposition as possible, the offer was made to cut out those local authorities who did not approve of the Company's scheme, but although 20 such areas have been cut out, there are still 64 in the Bill, the councils to which have either definitely approved or did not oppose.

The opposition divided itself into three classes, namely, the gas companies, the large county boroughs, and the railway companies. The latter objected to an extension of the Company's existing powers to break up their bridges, &c., but the offer was made to submit any application for laying lighting mains on the railway companies' property to the Board of Trade. The position of Sheffield, Leeds, and the other large towns is that at present under what is known as the "fringe" clause in the Electric Lighting Act of 1909, these authorities may supply any areas just over their existing municipal boundaries, and that what is now sought by the Power Company would enable competition to take place with them. Furthermore it is argued that complications would arise by the granting of these powers in the event of the municipalities extending their boundaries at some future date.

So far as the gas companies are concerned the opposition

was based on the fear of competition and emphasis was placed upon the fact that the Company did not propose to place itself in the position of an ordinary electric lighting company in regard to certain details, and this, it was claimed, made the competition unfair. It was pointed out that there was no obligation upon the Company to lay mains in any particular district, nor was any compulsory area scheduled in any of the districts. Similarly, the right of purchase on the part of the local authority did not exist. In this connection the Board of Trade had issued a report in which the same point of view was taken, and it was suggested that the Company, through its subsidiary concern, The Electrical Distribution of Yorkshire, Ltd., should continue to do what it has done in regard to some 16 other districts, namely, apply for separate provisional orders. This, however, it was argued by the Company, would not be profitable because the best districts available for lighting have already been dealt with in this way, and the remainder could not possibly support self-contained undertakings of the character suggested. Indeed, orders have been obtained in some cases, and allowed to lapse for this very reason. A clause had been agreed between the local authorities concerned and the West Riding County Council, by which if a supply is not given in any particular district before the end of five years from the passing of the Act, an application may be made to the Board of Trade to revoke the powers.

In support of the Company's application, two precedents were quoted, namely, the Kent Electric Power Co., which obtained electric lighting powers in its area in 1906, and the North Metropolitan Electric Power Co., in 1907. The former was unopposed, whilst the latter was opposed by the Walthamstow Urban District Council, whose district was cut out of the Bill at their request.

Mr. W. B. Woodhouse, the engineer to the Company, gave evidence on Friday. The Company is making considerable development in the use of coke oven gas for generating stations. Already one is in operation at Barraugh, and a considerable addition to the plant there is contemplated. Two others are also in hand, one at Castleford, and another near Doncaster. It is anticipated that the whole of the districts contemplated in the Bill can be dealt with from the lighting point of view for an expenditure of £60,000.

On Monday, after local evidence in support of the Bill had been heard, the Committee sent for a representative of the Board of Trade.

Mr. H. Booth, of the Board of Trade, confirmed the views expressed in the report referred to above, and said that when the electric power companies first came into existence, the intention was that they should concentrate on bulk supply and large power users, leaving the smaller local distribution to be in the hands of the local authorities. Many difficulties would present themselves in the event of a local council desiring to buy out the Company in its district. No terms of purchase were specified in the Bill, and it was probable that an arbitrator would have to take into account the fact that the Company held its lighting powers in perpetuity. Under the Electric Lighting Act of 1888, definite provision was made as to the terms upon which purchase was to take place, but this Act would not be incorporated in the present Bill.

As mentioned above, the Chairman announced, without calling on the opposition, that the clauses in the Bill relating to lighting could not be allowed, and as only a few subsidiary matters remained, the promoters intimated their intentions of not proceeding further.

ROYAL ENGINEERS

THE 1st London Divisional Engineers have recently enlisted a large number of recruits as a result of the special efforts put forth, but further men are still required for both Field and Signal Companies in the third line formations.

Men urgently required are those connected with the building constructional trades, bricklayers, carpenters, harness-makers and saddlers, blacksmiths, wheelwrights, shoemakers, telegraphists, electricians, instrument makers, telephone operators, and men accustomed to horses.

The 1st London Field Company has received very high praise for its work in France, the men having carried out their special work of preparing defence works, making temporary roads, bridging streams and water channels, cable-laying, and the establishment of field telegraphic communications, &c., under very hazardous, hard, and trying conditions.

It is desired that the men coming forward for the new companies shall maintain this splendid reputation for skill in work, individual pluck, and collective enterprise. The need for skilled men is great, and, of course, the pay is proportionately higher than in most other arms of the Service. A fully qualified carpenter can earn up to 45s. a week whilst in London, and 33s. 6d. plus the usual children's allowances whilst at camp. Full particulars can be obtained by application, personal if possible, to Headquarters, 10 Victoria Park Square, Bethnal Green, N.E., or to the Branch Recruiting Office, 451 Edgware Road, W.

THE L.C.C. NEW TURBO-GENERATORS

THE following tenders have been received by the L.C.C. for two 8,000-kw. turbo-generators for Greenwich:—
Cole, Marchent & Morley, Ltd., Bradford, £15,313 10s. (incomplete).

British Thomson-Houston Co., Ltd., Cannon Street, E.C., £51,070 (incomplete).

James Howden & Co., Ltd., Glasgow, £55,161 (incomplete).

James Howden & Co., Ltd., Glasgow (alternative tender), £56,720 (incomplete).

Maschinenfabrik Oerlikon, Switzerland, £57,600.

Fraser & Chalmers, Ltd., Erith, £58,012.

Fraser & Chalmers, Ltd., Erith (alternative tender), £59,709.

British Westinghouse Co., Ltd., Manchester (accepted tender), £62,003.

Fraser & Chalmers, Ltd., Erith (alternative tender), £63,816.

Escher Wyss & Co., Switzerland, £64,016.

Willans & Robinson, Ltd., Rugby, £64,620.

Willans & Robinson, Ltd., Rugby (alternative tender), £65,619.

Escher Wyss & Co., Switzerland (alternative tender), £66,311.

Willans & Robinson, Ltd., Rugby (alternative tender), £66,795.

Brush Electrical Engineering Co., Ltd., Loughborough, £67,062.

Willans & Robinson, Ltd., Rugby (alternative tender), £67,442.

Dick, Kerr & Co., Ltd., Cannon Street, E.C., £68,100.

The Highways Committee report that it was necessary to pass over the lowest complete tender, viz., that of Maschinenfabrik Oerlikon of Switzerland, on account of the difficulty which would be likely to arise in the transport of raw materials and of the completed work, and in the inspection of the machinery during manufacture. The next lowest tenders, viz., those submitted by Messrs. Fraser & Chalmers, have also been passed over on the advice of Sir Alexander Kennedy for the reason that this firm, although of the highest standing, have not constructed any turbines of a larger capacity than 3,000 kw. In view of the fact that the early delivery and smooth and speedy operation of these machines were of the utmost importance for the safe working of the undertaking, the Committee has felt bound to take into serious consideration the experience which the different firms tendering have had of machines of the type and size in question. The result is that the Highways Committee has accepted the next lowest tender, viz., that of the British Westinghouse Co., who have supplied four of the five turbo-generators at Greenwich.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Text-book on Wireless Telegraphy. By R. Stanley. 344 pp. 9 in. by 5½ in. 201 figures. (London : Longmans, Green & Co.) 7s. 6d. net; abroad, 8s. 2d.

We have little doubt that Prof. Rupert Stanley's text-book on wireless telegraphy will become the most popular text-book on this subject. It starts from the beginning—not from the historical beginning, but from the logical and scientific beginning—assuming no knowledge of the theory of electricity and magnetism, but imparting just sufficient of it to enable an ordinary student not over-gifted with mathematical knowledge to understand and appreciate the principles which underlie the practice of wireless telegraphy. Starting with a chapter which gives the reader a conception of the ether, and another explaining the electron theory in a simple and elementary manner, but at the same time, clearly and soundly, he passes on to magnets and the idea of magnetic lines of force. Calling these lines of strain, he next devotes merely enough space to static electricity to familiarise the student with the conception of electric strain. Then come four more chapters—electrical measurements; capacity and induction effects; induction coils, alternators, and transformers; and oscillatory discharges,—and a firm foundation has been laid upon which to build up the proper teaching of wireless telegraphy as a simply-understood application of the principles already learnt. The history of wireless telegraphy is given briefly and well, and the technical treatment of the subject is a sound and up-to-date description of present-day methods and apparatus.

In the chapter on undamped-wave systems, near the end of the book, an interesting section is devoted to the new Marconi system of continuous oscillations, but only a few lines are given to wireless telephony. Perhaps, however, the author is wise in practically confining himself, in the technical part of the book, almost entirely to that which has been accomplished and in successful operation, and avoiding the description of recent researches, the materialised results of which are still in the early and consequently rapidly-changing stages of development.

Wireless telegraphy is now an industry, and many are engaged in it who could not hope to master the complete mathematical and physical theory of electromagnetic radiation. Prof. Stanley has provided them with precisely the text-book which they should have; and he has also a gift which the writers of many excellent text-books do not possess, the art of being interesting. The book draws one into it as one reads, and many students will be deep into the subject before they realise the rapidity with which they are learning.

Electrical Engineering: A First Year Course. By F. Shaw. 147 pp. 8½ in. by 5½ in. 80 figures. (London : George Routledge & Sons, Ltd.) 2s. net; by post, 2s. 3d.

The chief utility of this book should be for the student who desires, during the vacation, to recapitulate the matter which has been dealt with in lectures and class-work during the term, and to consolidate his knowledge. But as a text-book, to teach step by step, it would not be employed successfully, except as an auxiliary to work under an extremely able teacher. For instance, the elementary fact that the total resistance of a number of resistances in series is obtained by simple addition is not stated as a more or less obvious one, but is deduced from Ohm's and Kirchhoff's laws; these laws are also invoked to prove that the joint conductance of a number of circuits in parallel is the sum of their individual conductances; and, finally, the two rules thus proved are applied to "discover" the relation between the resistance of a conductor and its length and cross section. It is like teaching a child to indicate the position of its right ear by pulling its left wrist round the back of its neck. Dynamo and motor armatures and fields are referred to as early as the seventeenth page of the book, and long before the dynamo and motor are described, in order to illustrate the conception of back E.M.F. The choice of the "Examples" (mostly in the form of City and Guilds examination questions) at the end of the various chapters are also frequently unfortunate, as to answer them correctly often involves knowledge which has not been imparted in the pages which precede them.

Brown's Marine Electrician for Sea-going Engineers. By A. E. Larkman and A. H. Larkman. 244 pp. 7½ in. by 5 in. 179 figures. (Glasgow : James Brown & Son.) 5s. net; abroad, 5s. 4d.

We had hoped, perhaps unjustifiably, from the title that this would be a practical and technical handbook to tell the electrician who is competent on land the points of difference between land and marine practice. The object of the book, however, is to give the marine engineer some instruction in things electrical, and we are bound to admit that the instruction given is at times rather crude. In a four-line preface to the second edition the authors state that the volume has been thoroughly revised and brought up to date, but exception must at least be taken to the word thoroughly. As a typical alternator an old Siemens revolving armature type is given, from which "a number of separate circuits may be supplied . . . by dividing the armature into sections and fitting as many pairs of slip-rings as there are sections." A little later we read : "Since the introduction of transformers, alternators have again come into use; they have been used and discarded intermittently by electrical engineers, but now their use aboard large vessels is probable." The reader is given the information that the series dynamo is "falling into disuse"; that the tree system of wiring was used exclusively for ship work until a short time ago, and "is now giving place to what is known as the 'distribution' or 'multiple circuit' system," and that voltmeters are not left permanently on circuit, but are switched on only when a reading is required, so as not to heat the coil. The chapter on instruments and testing is absolutely archaic.

British Association.—For the meeting which is to be held at Manchester from September 7th to 11th, under the presidency of Prof. A. Schuster, F.R.S., the following sectional presidents have been appointed :—Section G (Engineering), Dr. H. S. Hele-Shaw, F.R.S.; Section A (Mathematics and Physics), Sir F. W. Dyson; Section B (Chemistry), Prof. H. B. Baker.

Wiremen's Wages.—It is stated that the electricians employed on ships in the Port of London have been granted a 48-hour week and an increase of wages to 1s. per hour. We notified in a recent issue that the men had threatened to strike unless these demands were granted.

Municipal Wiring.—The South Shields Corporation Bill, which includes powers to wire and fit premises through a contractor, was before a House of Lords Committee last week. There was no opposition to the proposal in question. Through confusion with another Bill, we unfortunately stated on page 124 of our issue for March 18th that the wiring powers of the Doncaster Corporation had been granted. As a matter of fact, the clauses dealing with wiring were struck out of the Bill before it reached the Committee.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 22nd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

29,751/13. **Renewable Lamps.** V. TERRY and E. TERRY. Incandescent lamps in which the filaments may be renewed without wholly destroying the lamps. The filament support is mounted on a stopper or plug, which fits in the neck of the bulb. Provision is made to exhaust the bulb through a channel in the plug. (Four figures.)

624/14. **Motor Control.** G. ELLISON and M. R. H. MUELLER. Automatic cut-out for crane motors to break the circuit on an undue rise in speed of the motor. The controlling solenoid is provided with two windings, one in shunt with the armature, and the other in series with it, so adjusted that when a high back E.M.F. is attained on high speed with low load, such as when a heavy load is lowered too fast or a light load raised too quickly, the circuit is broken. (One figure.)

8,173/14. **Generator Protection.** B.T.-H. Co., F. H. CLOUGH, and J. WHITCHER. A method of protection of A.C. generators having parallel windings in the armature, in which the action depends on a comparison of the inductive effects of the current, in the parallel windings, or the current in one winding, with the sum of the currents in all the windings, so that the generator is disconnected in the event of an internal fault. (Four figures.)

17,326/14. **Incandescent Lamps.** I. LANGMUIR. High efficiency gas-filled lamps, in which a small quantity of mercury or other substance is contained in the bulb, which vapourises as soon as the lamp is hot. This vapour has an even better effect than inert gases, such as nitrogen, in preventing the volatilisation of the filament. (Three figures.)

17,945/14. **Electric Heaters.** R. WEAVING, F. SMITH, and FERRANTI, LTD. An electric heating element formed of a number of porcelain bars threaded on metal rods, each bar being provided with a single longitudinal ridge having two or more lateral projections on each side to hold in position a coil of helically-wound wire placed in a zig-zag position between the bars. (Nine figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: AYRTON [Carbons] 8,505/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. Co. (G.E. Co., U.S.A.) [System of distribution] 14,577/14.

Heating and Cooking: QUAIN [Heaters] 136/14, and [Water heaters] 3,221/14.

Instruments and Meters: CHAMBERLAIN & HOOKHAM, LTD., and SPRAGUE [Mercury motor meters] 14,841/14.

Switchgear, Fuses and Fittings: CELERI [Resistances] 9,411/14.

Telephony and Telegraphy: WITHERS (Coz) [Submarine telegraphy] 399/14; COMER [Telephone transmitters] 8,049/14; BETULANDER, PALMGREN, and GRAHN [Automatic telephones] 8,946/14; WESTERN ELECTRIC CO. (Woodward for W.E. Co., U.S.A.) [Telephone switching apparatus] 12,912/14; AUTOMATIC TELEPHONE MANUFACTURING CO. and SPERRY, 17,590/14.

Traction: SALMON and DODASON [Signalling] 11,801/14; WIGHT [Signalling] 11,805/14.

Miscellaneous: JONES and LIGHT STEEL TUBULAR WHEELS, LTD. [Welding] 8,804/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Traction: RENAULT [Car lighting] 24,121/14.

Miscellaneous: LANDIS & GYR A.G. [Spring contacts] 5,007/14.

Opposition to Grant of Patents

21,029/13. **Lamp Filaments.** C. O. BASTIAN. An appeal has been lodged against the Comptroller's decision to refuse a grant on this application. The specification describes lamps with wire filaments in helical form, with the convolutions arranged at a distance from one another equal to, or less than, one-half the diameter of the wire.

22,331/13. **Lamp Filaments.** C. O. BASTIAN. An appeal has been lodged against the Comptroller's decision to allow a grant

on this application, in spite of opposition. The specification describes helically-wound drawn-wire filaments, in which the wire is provided with a coating during preparation to keep the convolutions apart. This coating is removed after mounting the filament.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

9,284/01. **Railway Signalling.** E. TYER, F. T. HOLLINS, and F. W. LEAKE. A three-indication instrument for use at crossing gates, &c.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: I. LADOFF and J. MACNAUGHTON [Lamp electrodes containing titanium] 226/04.

DYNAMOS, MOTORS and TRANSFORMERS: SIR W. G. ARMSTRONG, WHITWORTH & CO. and C. H. MURRAY [Motor control] 439/09.

Switchgear, Fuses and Fittings: E. M. HEWLETT and T. E. BUTTON [Remote control oil switches] 15,955/02; T. McCLELLAND [Lamp-holders] 299/09; H. F. REASON and REASON MNF. CO. [Time switches] 353/09; J. J. RAWLINGS [Tumbler switches] 373 and 27,446/09; D. K. MORRIS and G. A. LISTER [Voltage regulators] 416/09.

Telephony and Telegraphy: V. POULSEN [Magnetic recording and reproducing of telephone signals] 541/03; E. A. HYTTEN [Telephones] 425/08.

Traction: G. W. MASCORD [Petrol-electric traction] 608/07.

Miscellaneous: J. H. and A. B. DRÄGER [Lamp for helmet of miner's rescue dress] 559/08.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

At the meeting of the Wireless Society of London on Tuesday, April 20th, Prof. E. W. Marchant delivered a lecture on "The Accurate Measurement of Wireless Signals." To a large extent it covered the same ground as his recent Institution Paper (ELECTRICAL ENGINEERING, February 11th, p. 60). He emphasised, however, the need of an increase in the amount of work of this kind being done throughout the country. Before attempting to make any experiments on the strength of received signals it is necessary, he said, as far as possible, to have constant conditions at the receiving station. The aerial should be of a standard pattern, and as free as possible from surrounding obstacles such as trees and houses. A second factor to which attention should be paid was the resistance of the aerial to earth, as in order to get good results the earth resistance should be as constant as possible. He had used a water-pipe system at Liverpool with satisfactory results. Having described a number of instruments for detecting wireless signals, Prof. Marchant said that the best was the instrument which would read the actual current or voltage on the antenna circuit. For extremely small powers the Duddell thermo-ammeter was probably the most sensitive alternating-current instrument. The elimination of atmospherics was a matter of great difficulty, and very frequently in the summer, even in Liverpool, it was necessary to have a conducting leak from the aerial to earth. A coupled secondary circuit for receiving the signals was greatly to be preferred to direct measurement. There was a certain loss of power, but the advantages to be gained in greater selectivity far outweighed any small loss in efficiency. In the course of a short discussion Mr. W. Duddell said he had been endeavouring to interest as many people as possible in the measurement of wireless signals. He had been three times to Brussels to get the nations of the world to make international measurements, but the war stopped the first co-ordinated attempt at these measurements during the eclipse. Even now, when all wireless work was prohibited, a lot of work could be done in trying to develop instruments which would actually measure the oscillating current itself either in the aerial or a circuit coupled to it. More sensitive instruments were required.

**QUESTIONS AND ANSWERS
BY PRACTICAL MEN**

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,440.

A mixed load (90 per cent. induction motors) of 300 kw. is required at 450 volts, three phase, 50 cycles, at a distance of 200 yards from the supply. Calculate size of three-core paper cable, and prove that it is the economical size when supply is 5d. per unit.—"CABLE."

(Replies must be received not later than first post, Thursday, May 6th.)

ANSWERS TO No. 1,438.

Could any reader describe in detail the apparatus used in taking the ohmic resistance of an electrolyte of fused salts, especially the apparatus containing the salt?—"ELECTROLYTE."

The first award (10s.) is made to "L.R." for the following reply:—

The apparatus for containing a fused electrolyte depends on the melting-point of the electrolyte. For instance, with low melting-points the apparatus used can be the same as that employed in connection with conductivity or resistivity determinations of solutions. In any event, the container should be non-conducting through the range of temperatures employed; it should be chemically inert to the action of the fused salts, and should be so arranged that a large electrode area can be used. It should not be variable over the temperature range employed, or if it be variable the change should be definitely determinable. A simple container is made of porcelain and in the form of a U, having expansions or cups at the top of the arms. The dimensions for fused electrolytes are as follows:—8 mm. internal diameter throughout the U; width across the two arms, 45 mm.; height from top of the arms (*i.e.*, base of extensions) to bottom of the U, 50 mm.; diameter of extensions, 16 mm.; height, 25 mm. The electrodes are formed of platinum cylinders, one in each cup, and rest on the bases of the cups. Their sizes are:—Height, 12 mm.; diameter, 14 mm.; and thickness of metal, 1·5 mm. Platinum wires lead the current to the electrodes. The apparatus is filled with electrolyte almost to the top of the cups, and is immersed in a suitable bath or furnace. A long description of the use of this apparatus is to be found in *Zeit. E. Chem.*, Vol. 12, p. 337. Another form comprises a plain thick walled capillary made of quartz, the bore being 1·5 mm. This is provided with platinum elbows, which form the electrodes, and to which leading-in and suspending wires of platinum are attached. A complete description of this form is to be found in "Transactions American Elec. Chem. Soc.," Vol. XI., p. 211.

To use either apparatus, it is connected in one arm of a Wheatstone bridge arrangement, another arm containing a resistance box of fixed value, and the other two being formed by a metre wire not less than $\frac{1}{4}$ mm. thick, formed of platinum iridium alloy or of constantan. In place of the usual battery a small induction coil excited by a battery is used, and in place of the galvanometer a telephone is employed. It is found best in practice to connect the telephone across the ends of the metre wire, and the induction coil has a fixed point of contact between the bath and the fixed resistance, the other contact being movable along the wire. The resistance box must contain either non-inductive resistances, or (preferably) in cases where the resistances are of high value, a thousand ohms or more, they are arranged in layers with reverse connections to avoid the capacity effect, otherwise obtained. Throughout their range the resistances should be continuously adjustable. The induction coil should be small enough to be worked by a single dry cell, and should not take more than half an ampere in any case. The secondary only requires a comparatively few turns, giving, say, 1,000 volts, because higher E.M.F.'s introduce disturbing effects. The spring of the coil should give a vibration of 250 to 1,000 per second, so that a clear singing treble tone is obtained. An ordinary telephone can be used of resistance about 10 ohms. In operation the electrolyte should be raised to the desired temperature, and balance obtained by sliding the moving contact along the bridge until the minimum sound is heard in the telephone. The resistance of the bath *W* is then found by

$$W = R \times \frac{\text{length } cd}{\text{length } bc}$$

where *b* and *d* are the resistance and bath-end points respectively of the bridge, *c* the moving point, and *R* the fixed resistance. From this the specific ohmic resistance can be obtained, knowing the dimensions of the bath used.

The second award (5s.) is made to "NEMO," whose reply in slightly abridged form is given below:—

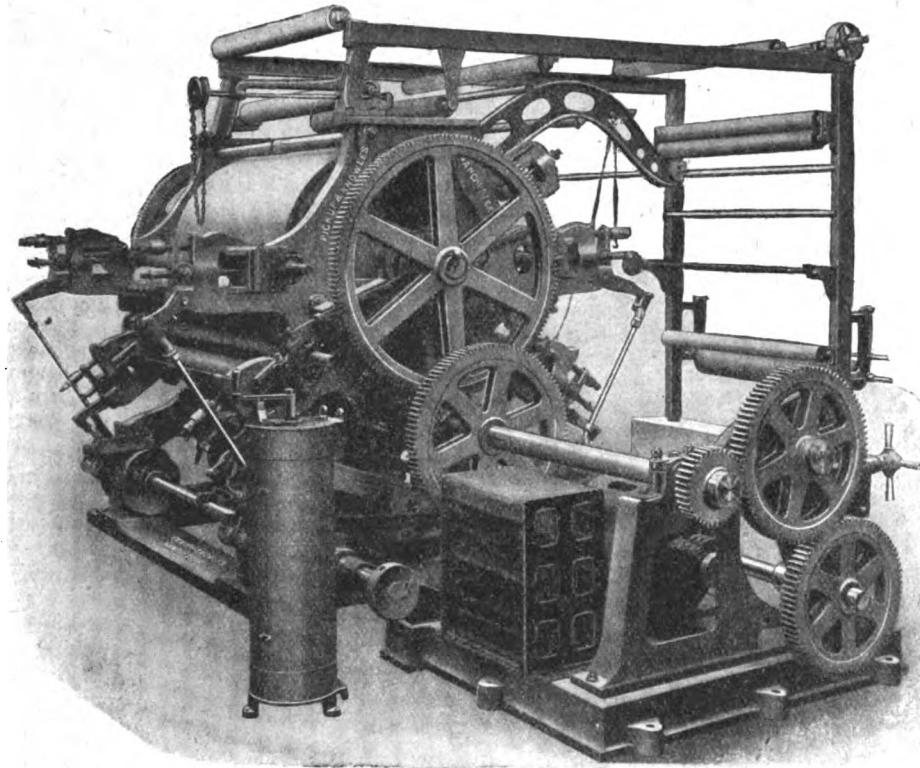
Ordinary Wheatstone-bridge arrangements are not available for this purpose owing to the back E.M.F. occasioned by electrolysis. To obviate this, alternating currents may be employed. Several A.C. testing outfits are on the market. A convenient arrangement is the portable Siemens slide-wire bridge with induction coil and self-contained dry battery, a telephone being supplied instead of a galvanometer for balancing purposes. Or an ordinary post-office box may be used, low-voltage alternating current being supplied through, say, a transformer and choking coil. If the leads from the box to the electrolyte are appreciable compared to that of the electrolyte, their resistance must be measured independently and subtracted. For very low resistances a modification of the ampere voltmeter (fall of potential) method may be employed. A considerable alternating current is passed through the electrolyte, care being taken not to cause heating, and the drop in millivolts is measured on a D.C. instrument fed from a vacuum thermo-couple shunted across the electrolyte, the shunt current giving the heating effect. This is calibrated to read potential difference in A.C. volts. Several measurements should be taken, and the specific resistance calculated by multiplying the observed value of the resistance by the cross-section of liquid or area of plates facing liquid, and dividing by the distance between the plates. Several electrodes may be employed and the results compared.

Electric Light Switching Competition.—The competition held by Messrs. A. P. Lundberg & Sons in our columns in November last is to be followed by another during May in the pages of our contemporary, *Electricity*.

Electric Vehicles.—At the last meeting of the Electric Vehicle Committee it was pointed out, in connection with the restriction of expenditure on publicity of many electricity undertakings under present conditions, that as the electric-vehicle load was entirely of an "off-peak" nature, their adoption would not necessarily entail extensions of plant, and it was urged that endeavours should still be made to make known the advantages of electric vehicles. Efforts are being made to persuade the undertakings in the metropolitan area who charge more than 1d. per unit for charging to reduce their charges. The importance of all vehicles being fitted with the standard charging plug is being urged. The committee has adopted 12 volts as the standard pressure for vehicle lamps, the lamps to be in accordance with the Engineering Standards Committee's specification No. 69. The committee's report on battery-charging equipments is nearly ready.

ELECTRICALLY DRIVEN CLOTH PRINTING MACHINES

AN interesting example of the electric drive as applied to the printing industry is shown in the accompanying illustration. The machine is a six-colour cloth printing machine arranged to print squares or rectangles with side and



ELECTRICALLY-DRIVEN SIX-COLOUR CLOTH PRINTING MACHINE.

cross borders in any length from one yard to ten yards increasing by one inch, and using rollers 18 in. in circumference. The machine is driven by a 25-h.p. three-phase "Witton" motor, the controller resistance being mounted on the bedplate of the machine. As will be observed, the motor is completely out of the way, and the illustration gives a good idea of the compactness of the electric drive. The electrical equipment was supplied by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.).

THE B.E.A.M.A. JOURNAL

THE second number of this quarterly has just appeared. Among the articles it contains are "German Kartells : Part II.," "Toward a National Policy for Industry," "Export Business to India," two excellent popularly-written articles on "Illuminating Engineering" and "Motor Control," by Mr. F. W. Willcox and Mr. Frank Walker respectively, and the all-important section, "The Work of the B.E.A.M.A.," which is placed near the end instead of at the beginning.

In this section, mention is made of a second edition of the Association's "Conditions of Sale," with six appendices relating to "tolerance," penalty, bonus and rejection limits, tests, guarantees, speed limitations, &c.; a cryptic note on "cross-tendering" excites curiosity; the position with regard to Canadian business and the "National Electric Code" is commented upon; and the publication of the second edition of the B.E.A.M.A. handbook, which supplements the E.S.C.'s British Standards for Electrical Machinery, is announced.

The value of the *Journal* would be greatly enhanced if this report of the work of the Association were more specific in character. The journal of a great association should do a little more than say that agreements, conventions, and standards relating to this, that, and the other have been arrived at "with much labour"; it should say definitely what the new agreements, conventions, and standards are, and explain why they have been chosen. To judge by the polyglot nature of the advertisements, the publication is intended chiefly for export, and the oversea buyer will hardly be

encouraged by being told that new conditions of sale and standards have been adopted by British manufacturers, while he is left quite in ignorance as to their true significance. For years past Consular reports from all parts of the world have reiterated the complaint that the British manufacturer has lost ground by placing himself on a pedestal and refusing to identify his interests with those of his potential customers abroad. It should be one of the duties of the B.E.A.M.A.

to break down these old-fashioned methods, which have done so much to help the foreigner to capture our export trade, but the inference to be drawn from these notes in the *Journal* is that the methods of the British manufacturer are becoming more and more inflexible, and his "take it or leave it" attitude accentuated. It has been revealed over and over again that the British manufacturer has lost ground in the past from his lack of adaptability. Recent events have proved, however, that he can adapt himself rapidly and effectively to new conditions, but a perusal of these pages of the *B.E.A.M.A. Journal* certainly tends to convey the opposite impression.

The war has taught most of us to see things in better perspective, but the B.E.A.M.A., if we had only to judge by this section of its *Journal*, might be either afflicted with near-sightedness or incommoded with blinkers.

ELECTRIC TRACTION NOTES

The engineering and mechanical workers on the District, London Electric, Central London, and City & South London Railways have been granted their demands for a permanent increase of 3s. per week in substitution for a war bonus of 2s. per week recently granted. As in the case of the wiremen employed on the Port of London ships, these men had threatened to strike within the next week unless their demands were granted.

In consequence of an objection by the Commissioner of Police, and also because of the impossibility at present of obtaining further trailer cars from the manufacturers, Clause 23 of the L.C.C. (Tramways & Improvements) Bill this year, which sought to enable the Council to run trailer and coupled cars on its northern tramway system, has been withdrawn.

The Highways Committee of the L.C.C. has decided, subject to the approval of H.M. Treasury, to adopt the following periods for repayment of capital expenditure involved by the substitution of turbines for reciprocating engines at the Greenwich power station:—(i) Expenditure on river works, foundations for new machinery, and alterations to buildings (added value as distinct from cost of substitution of new work for work destroyed) to be repaid within sixty years; (ii) expenditure on new plant and machinery (other than additional steam, exhaust, feed condenser, &c., pipes) to be repaid within fifteen years, on the understanding that, in the event of payments on the agreed basis being made into the renewals fund at any future date, the question of the period for repayment shall be reviewed; (iii) expenditure on additional steam, exhaust, feed condenser, &c., pipes to be repaid within twenty-five years; (iv) cost (recurring every five or seven years) of re-blading turbines and re-winding generators to be charged to revenue or renewals fund; (v) obsolete capital expenditure to be repaid within three years from the time that the whole of the old plant is displaced.

CATALOGUES, PAMPHLETS, &c., RECEIVED

SWITCHES.—A new edition from A. P. Lundberg & Sons (477 to 489 Liverpool Road, N.) of their catalogue of "Pivot" single-way and two-way tumbler switches contains particulars of the latest forms of these switches in the surface and flush patterns, with ordinary and Admiralty pattern terminals with or without locking devices for the covers, and other modifications. An important point about the movement of these switches is the independent "off" motion, according to which the speed of the break is not determined by the operator.

CONDENSING PLANT.—An interesting illustrated pamphlet from the Contraflo Condenser & Kinetic Air Pump Co., Ltd. (3 Central Buildings, Westminster, S.W.), describes with the aid of photographs of actual installations the principal features of the Contraflo kinetic system of condensing and air pump plant, with which very high condenser efficiencies can be obtained.

CONTINUOUS-CURRENT MOTORS.—A descriptive list from the British Thomson-Houston Co., Ltd. (Rugby), deals with their latest pattern of continuous-current motors, ranging from 0·15 to 10 h.p. These are made in the protected, enclosed ventilated, drip-proof, pipe ventilated, and totally enclosed types, and a very convenient method of ascertaining the most suitable speeds and pulley diameter for any given case by means of curves is employed.

IRONCLAD SWITCHES AND FUSES.—The Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex, and 123-125 Queen Victoria Street), have issued a new leaflet giving particulars of "Foolproof" quick make and break ironclad switches and switchfuses. These articles have been considerably reduced in price, a fact of interest in view of the large amount of new machinery now being installed by manufacturers executing war contracts.

POCKET LAMPS, &c.—The latest list of the products of the New British Ever Ready Co., Ltd. (Hercules Place, Holloway, N.), contains a very large variety of patterns of hand lamps, pocket lamps, torches, &c., supplied by dry cells, as well as illuminated ceiling and other clocks, portable bell sets, &c.

ELECTRICAL SUPPLIES.—Leaflets from Donovan and Co. (47 Cornwall Street, Birmingham) give particulars of "Barwick" British-made motor starters, carbon filament lamps, and other electrical supplies.

Lundberg's Switching Competition.—A little leaflet has been issued by A. P. Lundberg and Sons (477-489 Liverpool Road, N.) containing extracts from letters from candidates in these competitions expressing great appreciation of their utility.

"Witton" Explosion-proof Switchgear.—In addition to an extensive application in fiery mines, "Witton" explosion-proof motors and switchgears are occasionally put to service in a number of unusual circumstances. Gunpowder factories are one of the many works fitted with this class of motor in the normal routine, but a curious application has been found in a hydrogen factory, where it was specified that the switchgear should be explosion-proof in order to guard against explosions due to gas leakages. The General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), supplied the switchgear for this installation.

Electric Vehicles.—Mr. R. J. Mitchell, in a lecture recently before the Junior Institution of Engineers, referred to the progress made by electric vehicles in the United States, where over 75,000 were in use, and said that improvements had been such that the modern electric vehicle would remain an exceedingly useful machine, were it not improved for the next twenty years. He enlarged upon the advantages of electric over petrol vehicles, especially from the points of view of economy and repairs. The modern accumulator, he said, had reached the point of being entirely dependable, and in the case of the Edison all-steel alkaline accumulator, a guarantee of four years, enabling the user to depend on at least one hundred thousand miles' service, was available.

Motor-car Head Lamps.—Looking forward to the time when motor-car head lights are allowed to be used more generally again, the General Electric Co., Ltd., have introduced a system in which a pair of head lamps fitted with 10 c.p. lamps are supplied by a small dynamo worked by a friction drive off the engine flywheel entirely without accumulators. The machine is put in and out of action by a Bowden wire arrangement. In view of the fact that the head lights are only really required when the engine is running, the system, owing to its simplicity, has much to recommend it in cases where it is desired to have only the head lamps electrically illuminated, and the use of oil lamps for the side, back, and any other lights is not objected to. The machine gives a remarkably constant voltage over a wide range of engine speed. A still smaller size is made with 6 c.p. lamps for light cars.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aldershot.—The Council recently applied for a loan of £8,500 for extensions, which they consider it is absolutely necessary to carry out. The L.G.B., however, has refused to sanction any amount except that wanted to meet war requirements. The latter has been referred to the Electricity Committee to deal with, as there is a feeling that the whole amount should be pressed for.

Australia.—Four 250-k.v.a. three-phase transformers; also 9,680 yards of 0·05 sq. in. three-core lead-covered cable. Messrs. McIlwraith, McEacharn & Co., Biliter Square Buildings, E.C. May 18th.

Turbine-driven boiler feed pump; for mechanically-fired water-tube boilers and two circulating pumps. Messrs. McIlwraith, McEacharn & Co., Biliter Square Buildings, E.C. June 15th.

The Victorian Railway Commissioners require recording apparatus for checking the consumption of electrical energy in train operation. Full particulars should be sent to the Agent-General for Victoria, Melbourne Place, Strand W.C., not later than May 19th.

The Melbourne Deputy Postmaster-General requires 8 miles of paper-insulated lead-covered cable. June 1st.

Barnsley.—The Borough Electrical Engineer has prepared a scheme of extensions at the power station, and also to the mains.

Bolton.—A L.G.B. inquiry was held last week concerning a loan of £45,032 for the electrical undertaking. The Inspector, Mr. H. Shelford Bidwell, mentioned that the Board was not very much disposed to grant sanction to this loan. The Town Clerk replied that the Corporation had suspended other works to the extent of about £275,000, and this, he thought, showed their desire to comply with the requirements of the Treasury. Of the loan now asked for, £28,032 was for converter plant for the new power station, and the remainder for equipment of sub-stations on consumers' premises, and mains.

Dover.—A L.G.B. inquiry was held last week concerning a loan of £6,000 for a 1,000-kw. turbo-alternator. The Inspector, Mr. H. Shelford Bidwell, said that the amount would have to be reduced by £1,000, as this apparently dealt with private consumers. The Borough Electrical Engineer said that the plant was necessary, as the Department was supplying firms engaged on war contracts.

Johannesburg.—200-ampere circuit-breakers. Further particulars at 73 Basinghall Street, E.C.

Wiring

London: L.C.C.—250 lighting points at the Sebon Street School, Islington. May 12th. (See advertisement on another page.)

Southampton.—Lighting of Men's Home at the Workhouse. Clerk. May 5th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdeen.—New baths (£2,000).

Coventry.—School in Folly Lane.

Dunfermline.—School at Rosyth (£16,000).

East Ham.—School, Dersingham Avenue.

Wigan.—New public hall. Architect, R. Pennington.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Belfast.—A contract has been placed with Siemens Bros. Dynamo Works for a twelve months' supply of carbon filament lamps for the Corporation tramways.

London: L.C.C.—The following tenders have been received for cables in connection with an additional temporary supply of power up to 3,500 kw. to be obtained from the London Electric Supply Corporation:—Western Electric Co. (accepted), £6,214; British Insulated & Helsby Cables, Ltd.,

£6,298; W. T. Henley's Telegraph Works, Ltd., £6,407 19s.; Johnson & Phillips, £6,696 8s.; W. T. Glover & Co., £6,742 18s.; Siemens Bros, & Co., £6,798 17s.; Callender's Cable & Construction Co., £6,833 2s.

Mansfield.—A loan of £2,000 is to be taken up for transforming and converting plant to supply current to the Clipstone Camp. The cost of the necessary main is to be paid for out of reserve.

Contracts have been received by Venner & Co. for Chamberlain & Hookham meters from the Cardiff, Grimsby, and Hornsey Corporations.

Messrs. Scholey & Co. have received contracts for the supply of tool-steel gears and pinions from the Croydon Corporation Tramways Department, and large orders have recently been received from the Oerlikon Co. (L. & N.W. Railway electrification), L.B. & S.C. Railway, East Ham Corporation Tramways, Pretoria Corporation, Colombo Electric Tramways & Lighting Co., Johannesburg Corporation, and the Auckland Electric Tramways Co.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £87 to £88 (last week, £81 10s. to £82 10s.).

Agencies.—A merchant in Copenhagen desires to secure the agencies of British manufacturers of electrical fittings of all kinds, dynamos, small motors, and meters; and a Brisbane firm desires to represent British manufacturers of electric cranes. Further particulars in both cases at 73 Basinghall Street, E.C.

Change of Telegraphic Address.—The telegraphic address of the Westminster Tool & Electric Co. (Suffield House, Laurence Pountney Hill, Cannon Street, E.C.) has been changed to Westoleco—Cannon, London.

Change of Address.—The British Electric Transformer Co., Ltd., have closed their offices and showrooms in Charing Cross Road. All communications should be sent to Hayes, Middlesex. (Telegrams: Transfundo, Hayes, Middlesex. Telephones: Ealing 226 and Southall 101.)

Cooking Apparatus.—The Armorduct Mfg. Co., Ltd. (Farringdon Avenue, E.C.), announce that owing to rearrangements at their works at Witton (Birmingham) they have discontinued the manufacture of Mr. Napier Prentice's "Lightning" cooker, for which they held the sole licence.

Kinglite Candle Lamps.—The Kinglite Co., Ltd. (Pyke House, 19, 21, 23 Oxford Street, and Soho Square, W.), have disposed of their business in electrical accessories and silk shades to the Edison & Swan United Electric Light Co., Ltd. Practically the whole staff have been transferred to Ponders End, and Mr. W. J. Owen, Managing Director, has accepted a position with the Edison & Swan Co., and will continue to superintend the business he has been instrumental in establishing.

LOCAL NOTES

Belfast: Electricity Works Reorganisation.—The proposal to appoint a Special Committee to inquire into the administration of the electricity undertaking, as mentioned on p. 180 of our last issue, has been passed by the Corporation.

Bury: "Electricity at the Pit's Mouth."—The Electricity Committee report that during excavations in connection with the extensions at the Chamber Hall power house, a coal seam was struck, and that a number of tons of coal had been obtained which have been used at the works.

Hull: Suspension of Capital Expenditure.—The Deputy Electrical Engineer has reported that, in accordance with the instructions of the L.G.B., all capital expenditure on mains, services, and motors on hire ceased temporarily as from March 31st. He suggests, however, that it would be undesirable to cease connecting up new services, and recommends that this is to be continued out of revenue.

London: L.C.C.: Pressure-testing Stations.—The Highways Committee reports that of the 154 pressure-testing stations requisitioned by the Council from the various electric supply authorities in the County of London, 114 had been established up to December 31st, 1914. Stations are now in operation in each area of supply in the County with the exception of the areas of the Chelsea Electricity Supply Co. and the St. Pancras Borough Council, in respect of which the Council's inspectors have no jurisdiction. The position generally is regarded as satisfactory, and the Committee does not consider the present time opportune for the establishment of the full number of stations.

Manchester: Electricity Charges.—It is anticipated that a slight revision of charges for electric supply will have to be made in view of the increased cost of coal. The Electricity Committee proposes to contribute the usual sum of £30,000 during the coming year from electricity profits to relief of rates. The total net surplus for the year to March 31st was £35,850, against an estimate of £30,500. The cost of the war allowances to the employees at the front to March 31st was £6,015.

Stafford: Control of Electricity and Gas Undertakings.—A proposal that the control of the electricity and gas undertakings should be placed in the hands of separate committees has been negatived by the Council. It was pointed out, in the course of the discussion, that there is only one other place in the United Kingdom where the electricity and gas undertakings are controlled by one committee, viz., Alloa, in Scotland.

APPOINTMENTS AND PERSONAL NOTES

A switchboard attendant is required by the Lincoln Corporation. (See an advertisement on another page.)

Wiremen are required by John Brown & Co. (See an advertisement on another page.)

The B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.:—The Mirrlees Watson Co., Ltd.; John Musgrave & Sons (1913), Ltd.; Newton Brothers (Derby), Ltd.; Isaac Storey & Sons, Ltd. (Branch of United Brassfounders & Engineers, Ltd.).

Diesel Engine Users' Association.—At a recent meeting of the Diesel Engine Users' Association, a standard policy for insurance of Diesel engines at Lloyd's against breakdown was approved and adopted. This includes advantageous terms to members of the Association, and arrangements for periodic inspections of the plant by special experts. A discussion on the lubrication of Diesel engines was opened by Mr. H. L. Alderton (Guildford), who described the various methods of lubrication employed, and emphasised the importance of selecting the best oil for cylinder lubrication to avoid troubles from carbonisation and gumming. Large engines required more oil in proportion to their output than do the smaller engines. In the further discussion it was shown that practice varied considerably in regard to the use of one or several oils with Diesel engines. In some cases one class of oil is used throughout the engine, and in others different oils for the bearings, cylinders, and compressors. The methods of filtration of oil also showed a considerable variation. It was decided to ask for returns from members giving information as to the methods of lubrication employed, with quantities and costs, with a view to further discussion on the whole subject of lubrication at a subsequent meeting. The next meeting will be on Wednesday, May 19th. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, at 19 Cadogan Gardens, London, S.W.



ELECTRICAL ENGINEERING

With which is Incorporated
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SUMMARY

A FURTHER article on the Electrical Emergency Service appears on p. 192.

MR. DICKINSON's paper on the Bombay Hydro-electric scheme was discussed at the London meeting of the Institution of Electrical Engineers last Thursday (p. 193).

A NEW method of lift control in which an attendant in the car is not required has been adopted at some of the stations of the London Underground Railways (p. 193).

A NATIONAL conference of representatives of the Electric Supply and Gas interests will be held to-day at the Institution of Electrical Engineers to discuss the coal crisis (p. 194).

A SIMPLE indicator, to test whether faults on a tramway line persist, without replacing the circuit-breaker, is described by Mr. G. G. Braid of the Glasgow tramways (p. 194).

THE paper by Mr. J. H. Rider on the use of electric power at one of the large groups of South African gold mines, read recently at the Institution of Electrical Engineers, and also before some of the Local Sections described a scheme as large as the supply of the whole of London and included many points of interest in connection with the large three-phase and Ward-Leonard electric winders employed, the drive of the stamps, tube mills, pumps and air compressors as well as the arrangements for distributing and metering the supply from the power company (p. 195).

FURTHER experiments on the safety of colliery-bell

signalling have been conducted by Dr. R. V. Wheeler, of the Home Office, who finds that bells may be constructed with a sufficiently low self-induction to render the break spark on the bare wires innocuous (p. 197).

THREE further electric miners safety lamps have been approved by the Home Office (p. 197).

Two patent specifications relating to electric furnaces have been published during April (p. 197).

A THREE-PHASE winding plant employing a new type of liquid controller has been installed at a colliery in the Midlands (p. 198).

THE design of porcelain insulators for heating coils is dealt with in our "Questions and Answers" columns (p. 199).

THE case for A.C. motors for foundry crane work was discussed in a paper recently read by Mr. R. H. McBain before the American Institute of Electrical Engineers (p. 199).

AMONG the subjects of Specifications published by the Patent Office last Thursday are electric water-heaters, arc lamp carbons, and power factor regulation (p. 200).

MAINS, services, transformers and switchgear are required at Haslingden; two 12,000-kw. turbo-alternators at Sydney; mains, services, and meters at Battersea and Stepney; rotary converter and switchboard panel at Leigh (Lancs); and switchboard extension at Coventry (p. 201).

THE clerical staff in the Aberdeen Electricity Department are being trained as switchboard attendants.—Increases in tariffs are to be made at Manchester and elsewhere.—The reorganisation scheme at Belfast is again in abeyance (p. 202).

SATISFACTORY results of 1914 are shown by the accounts of the B.T.-H. Co., Willans & Robinson, and the South Wales Electrical Power Distribution Co. (p. 202).

Arrangements for the Week.—Friday, May 7th.—Junior Institution of Engineers, 39 Victoria Street, S.W. Informal discussion. 8 p.m.

Royal Institution. Evening discourse. "Electrons and Heat," by Prof. O. W. Richardson. 9 p.m.

Saturday, May 8th.—Afternoon lecture, II.: "Photo-Electricity," by Prof. J. A. Fleming, F.R.S. 3 p.m.

Association of Mining Electrical Engineers. Joint meeting with National Association of Colliery Managers, University College, Nottingham. "Protective Devices," by E. K. Scott. 3.30 p.m. (Postponed from April 24th.)

Tuesday, May 11th.—Society of Engineers, at Victoria Embankment. "Some Future Developments in Heating and Ventilation," by A. H. Barker. 7.30 p.m.

Wednesday, May 12th.—Institution of Electrical Engineers, Yorkshire Section, Philosophical Hall, Leeds. Annual General Meeting. "The Power Supply of the Central—Mining—Rand Mines Group," by J. H. Rider. 7.30 p.m.

Thursday, May 13th.—Iron and Steel Institute, at Institution of Civil Engineers. Annual Meeting. 10.30 a.m.

Friday, May 14th.—Iron and Steel Institute. Annual Meeting. 10.30 a.m.

THE ELECTRICAL EMERGENCY SERVICE

THREE are still many young men, keen and anxious to join the Army, who are being kept at home and obliged to continue their duties as switch-board attendants until other men who are unable to go away and fight can be found to fill their places. At the moment, we are devoting our attention particularly to London, where some hundreds of men will be wanted to give full time or part-time work to enable these to go.

Applications continue to come in, and we have enrolled many members in the "Electrical Emergency Service"; several are now already on duty at sub-stations in various parts of London, but very many more are wanted. Some of our readers have placed themselves at our disposal for full shifts, and have been placed on duty with very little delay, but the greatest number of offers have been for half-shifts (averaging four hours) for alternate nights. To release each man, four half-shifts on alternate nights are of course required, and for working half-shifts in the midnight hours, it is obvious that the volunteers must be men living near the stations or sub-stations. Some of the people on our register are still unplaced, owing to there being no call at present in the particular district in which they reside, but others are living in districts in which their services are required but are being kept waiting for more enrolments in order that the groups of four may be made up. We want *every* electrical engineer in London who will give four hours a day, or four hours on alternate nights, to become enrolled, and we want them most urgently in the following districts: Hammersmith, Wandsworth, Tooting, Streatham, Clapham, Stockwell, Battersea, Camberwell, Holborn, Camden Town, Islington, Mildmay Park, Clapton, Hackney, Limehouse, Barking, Poplar, Woolwich, Lewisham and Forest Hill. Although this list is a long one, it by no means represents the whole of the requirements; but in these districts the demand for assistance is being acutely felt.

Moreover, it is the *good* men we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees,

but who are willing now to defer their rest a little longer in view of the national emergency. Many such men are making excellent special constables, some have already enrolled themselves in the Electrical Emergency Service, and there will, we hope, be many more who will do so when they read this appeal.

The following Engineers and Managers of electricity works, &c., in Greater London have expressed their approval of the Electrical Emergency Service:—Mr. Sydney W. Baynes (St. Pancras), Mr. A. W. Blake (Willesden), Mr. J. H. Bowden (Poplar), Mr. E. Calvert (Finchley), Mr. A. C. Cramb (Croydon), Mr. C. S. Davidson (Barnes), Mr. A. L. C. Fell (L.C.C. Trams.), Mr. Herbert Jones (Waterloo—City and L. & S.W. Rly.), Mr. G. W. Keats (Woolwich), Mr. W. E. Kidner (Acting Engineer and Manager, Barking), Mr. J. D. Knight (Ealing), Mr. W. E. J. Heenan (Bermondsey), Mr. A. V. Mason (South Met. Elec. Trams and Ltg.), Mr. G. W. Partridge (London Electric Supply Corp.), Mr. G. M. Powell (Smithfield Markets Electric Supply Co.), Mr. L. L. Robinson (Hackney), Mr. E. T. Ruthven-Murray (North Metropolitan Electric Power Supply Co.), Mr. Roger T. Smith (G.W. Rly.), Mr. C. P. Sparks (County of London Co.), Mr. H. W. Sprunt (South London Electric Supply Corporation), Mr. G. R. Spurr (Walthamstow), Mr. H. P. Stokes (Bexley), Mr. J. E. Tapper (Beckenham), Mr. W. C. P. Tapper (Stepney), Mr. H. Tomlinson-Lee (Wimbledon).

[By an unfortunate printers' error last week, Mr. Roger Smith was given as S.W. Rly., instead of G.W. Rly., and Mr. Sparks' name was wrongly spelt.]

Applications for enrolment, on the form below, should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

The Service Required.

- A. A full eight-hour shift a day, or—
- B. A half-shift (four hours) daily (1st week morning, 2nd week afternoon, 3rd week night, in rotation).
- C. A half-shift every day, without midnight work.
- D. A half-shift alternate nights with no day work.

To prevent any suggestion of competition with regular employees, wages will be paid in proportion to the existing rates at the works at which the member is employed, and to the time given.

A week's notice will be required from any member leaving the Service.

APPLICATION FORM.

(Please cut out, fill in, and return to the Editor of "Electrical Engineering," 203 Temple Chambers, London, E.C.)

I wish to be enrolled as Member of the Electrical Emergency Service.

Age.....

Married or Unmarried.....

Qualifications (state electrical experience)

.....
.....
.....

I am willing to work a full shift as (A) (above),

a half shift as (B), (C), (D).

(Delete the line and letters not applicable.)

My regular occupation prevents me at present from giving electrical emergency service between.....a.m. and.....p.m.

Signature

(Please write very
distinctly, and give
addresses very fully.)

Residential Address

Business Address

THE BOMBAY HYDRO-ELECTRIC SCHEME

MR. R. A. DICKINSON'S Paper dealing with the Bombay Hydro-Electric Power Scheme, of which an abstract was given on p. 188 of last week's ELECTRICAL ENGINEERING, was read before the Institution of Electrical Engineers in London on Thursday. At the conclusion of reading the Paper, Mr. Dickinson showed a number of photographs of the works in progress, which brought home to the members, probably better than the Paper itself did, the magnitude of the scheme undertaken. This was further emphasised when Mr. Dickinson pointed out that the masonry used in the construction of the Shirawat dam is considerably more than that used in the construction of the Assouan dam on the Nile, whilst the Walwhan dam is only a little smaller than the Assouan dam.

MR. ROBERT HAMMOND, who opened the discussion, believed that the fall of 1,725 ft. between the reservoirs and the power house was the largest in any scheme of this nature. He considered that 100,000 volts was a rather high transmission pressure for so short a distance. In America, for transmissions of from 40 to 80 miles voltages varying from 30,000 to 70,000 had been adopted. He also wished to know why suspension insulators had been adopted, and stated that one of the Niagara companies had had considerable trouble with the excessive swinging of this type of insulator, and a special means had been devised to prevent it. Dr. Pearson, who had had much experience of long-distance transmissions, preferred pin insulators even with very much higher voltages than 100,000.

MR. T. O. CALLENDEB referred to the difficulties encountered in carrying out the works, not the least of which was that of labour. Bombay was to be congratulated upon having the scheme, and also upon the manner in which it had backed it up financially.

MR. J. H. RIDER regretted that so much of the plant in the Bombay scheme had not come from Great Britain. As to the line voltage, a great deal of risk was incurred by going too high, and he did not think in this instance the results would have been less economical had a lower pressure been adopted. He commented adversely on the use of belt-driven governors on the turbines. Apparently Mr. Dickinson had no earthing connection on any part of this system. On the Rand it had been found that earthing several places of the system had been most necessary to reduce risks from lightning, and it would be interesting to know why the generator of the neutral point in the Bombay case had been deliberately left unearthing. It appeared also that only one horn lightning arrester was used in series with an aluminium arrester. Had Mr. Dickinson had any experience of the operation of these, and had he found one horn arrester sufficient? On the Rand there were four or five horn arresters in series, and aluminium arresters were not used at all. With regard to the transmission line, he would rather anticipate troubles from corrosion owing to the large surface for moisture to act upon, due to stranded conductors being used. Notwithstanding Mr. Hammond, he thought a suspension type of insulator was the right one. It had been adopted on the Rand, and no trouble had been experienced from the swinging. He would like to know, however, whether six insulators in series were safe for 100,000 volts. On the Rand they were using six in series for a 80,000-volt line, and on a small transmission scheme out there, which he had designed, on 20,000 volts over a distance of 22 miles there were two in series.

DR. E. ZOELLY (Escher, Wyss & Co.), speaking on the question of belt-driven governors, said that all the experience of his firm was that this was the best type. They had frequently had to replace a rigid drive by the belt drive. With rigid drive, mechanical shocks were conveyed to the governing plant and led to trouble.

GENERAL B. LOVETT said this was the first hydro-electric scheme in India to be financed on a commercial basis. Its predecessors were all financed by municipalities. In this case, although the scheme received encouragement from the Government, Mr. Tata did not succeed in raising the necessary funds in London, but was able to obtain the necessary capital in India.

MR. G. B. TWISS thought that the factor of 4 for the towers, although satisfactory in this case, was not a figure which should be taken as a precedent. The insulators used by Dr. Pearson were not really pin insulators, but suspension insulators, one above the other making what might be called a rigid suspension insulator. The Bombay scheme was noteworthy on account of the material for the transmission lines having been wholly manufactured in England.

SIR JOHN McCRAW (Agent-General for New Zealand) referred to a number of power transmission schemes which are being carried out in his colony, and mentioned that those who financed these schemes were sure of receiving the most fair treatment from the Government.

DR. A. H. RAILING pointed out that during the three months of the year sufficient water had to be accumulated to supply 88,000 h.p. for twelve months, and therefore the diversity factor of generation was immense. He considered some of the temperature rises specified rather high considering the overloads allowed for.

MR. G. F. SILLS said there was a scheme in operation in Germany in which 100,000 volts were used for a 45- or 50-mile transmission line. As to the number of insulators, on the 110,000-volt Toronto transmission line they use eight in series, and during four years' working there had only been five hours shut down for the whole 400 miles.

MR. DICKINSON replied briefly to a few of the points raised in the discussion, and promised a fuller reply for the Journal. He went on to say that there was the highest recorded rainfall in the world in the area of the dams, and it had been as high as 540 inches in 90 days. Nevertheless, within three miles of where the 540 inches were recorded, less than 60 inches fell, so that it would be realised what great care was necessary in selecting the sites for the reservoirs. If they had been put two or three miles in different directions there would probably have been no water at all. As showing the care with which this matter had been approached, it was not without interest that one of the deciding factors in the selection of the sites was the existence of certain land crabs, which must have water, and when they were found in great quantities this led to the conclusion that there must be water in this district. The capital of the scheme was divided equally into debentures, preference shares, and ordinary shares. When it was in full working order within two years he did not think he was over sanguine in saying that the ordinary shareholders should receive a 30 per cent. dividend.

IMPROVED LIFT CONTROL ON THE UNDER-GROUND RAILWAYS

A NEW system of lift control, dispensing with the necessity for the presence of an attendant within the car, and providing for external control from the landings, is being adopted at some of the stations of the London Underground Electric Railways. Ten lifts at various stations, including Euston, Great Central, Piccadilly Circus, and others, are already equipped, and a further improved system with the same object is ultimately to be applied to forty-one more lifts. The object of the change is not really to save labour, as unless a group of three or more lifts are being worked together as many attendants are required. Thus two men are still required for two lifts as before, although they are at the top and bottom landings instead of in the cars. This has the advantage of a man being always at hand to deal with passengers' inquiries, and, again, the attendant does not need to wait for the last passenger, as, owing to his being always aware of the position of both cars, the ideal of having one ascending while the other is descending can be more nearly attained. An important part of the system is the depth indicator, which is in the form of a box containing a lamp running vertically on two metal guides, which form the lamp leads, and mechanically driven by the motion of the car. This is mounted over the lift-doors directly above the usual red indicator lamp which, owing to the action of a switch worked by the car through a cam, lights up when the car approaches the landing, and stays alight till the entrance-door is closed.

The control of the air-operated gates and doors in the car and at the landings is now effected from control boxes containing a series of push-buttons or plungers, which control the solenoid-operated air valves admitting compressed air to the cylinders working the gates. One box is provided at the top and one at the bottom of each lift, and these are kept locked when not in use. An additional plunger is also provided, by which the red indicator lamp can be extinguished when it is desired to show which of several lifts standing at the landing will start first. The same control box also contains the push-button by which the lift is actually started, and an emergency stop button. The top landing box has also another button, by which the lift can be started up from the bottom, but this is only used in special circumstances, and is ordinarily kept covered by a metal slide, so that it cannot be worked by mistake. The bottom control box can only be used to start the lift in an upward direction. The gate control is so arranged that the exit car gate and landing door are opened or closed together on pressing the correct plunger, while the entrance car gate and landing door, although opening together, have their solenoid valves interlocked with their limit switches in such a way that the car gate closes first and the door after it without any further operation. This is to enable the attendant to see that the car gate is closed safely. The valves are also interlocked with the starting-control circuits, so that the lift cannot be started unless all gates and doors are closed. The landing doors are also mechanically locked unless the lift is at the landing, and the car gates are prevented from being opened at the wrong time by hand, as they are difficult to move against the

air pressure. As sometimes only one lift is being worked at a time, car control is retained, as only one man is then required. For this purpose a similar box is provided in the car with plungers for working the gates in the same way. Starting is effected by the ordinary controller handle, although the controller itself has been simplified, and only retains two contacts. The emergency stopping switch, which was a feature of the original control, is retained. Another minor alteration is provision of a panel of expanded metal in the car through which the attendants can call to the passengers in the car in case of necessity.

The solenoid valves used for the gate control are of a special type designed for the purpose, of simple construction, and arranged so that the coils and working parts can be withdrawn without breaking any pipe joints. In the perfected form of the apparatus the valves will be integral with the cylinders. The modifications to the main control gear in the motor room over the lift shaft are not very great, although they required some ingenuity in arrangement. They consist mainly in the addition of a rising and falling spindle and disc and the necessary spring contact to convert the electro-magnetically-actuated reversing switches into "stick relays," which hold on once their control circuit is momentarily closed by the starting push-buttons or car-controller. The cars are stopped at the landings as before by the working of the limit switches, and the arrangement of the clapper switches by means of which the automatic acceleration and braking is accomplished is unaltered.

There will be slight differences in detail in the further perfected system referred to above, but these lie more in the design of the items composing the equipment than in the principles on which the control is carried out. We understand that the control gear of the older lifts on the Central London Railway, which works on quite a different method, is also to be rearranged on an improved system. It is thus evident that the company is doing its utmost to make its existing lifts as efficient in their working as possible, although it is unlikely, in view of the success of the escalators now in use at the newer stations, that any further lifts will be put in on future extension work. We wish to express our thanks to the Engineers of the London Electric Railway Co. for permission to inspect and describe this equipment, and particularly to Mr. W. S. Graff-Baker for the trouble he took in explaining the details to our representative.

COAL SUPPLIES AND THE WAR

NOTWITHSTANDING the various conferences with the Board of Trade, the reports of committees, &c., the question of supply of coal to electricity works and other public undertakings is getting even more urgent, and requires most serious consideration by the Government and no loss of time in the taking of remedial measures. The state of affairs in respect of depleted stocks of coal and difficulty in obtaining supplies by rail and sea, together with the abnormal increase in freights and in coal prices for present and future requirements, is most serious, and the situation is being made still worse by the demands for enormous increases in wages by the miners. We are glad to be able to announce therefore that it has been decided to hold a National Conference of representatives of the Gas and Electric Supply Industries for the purpose of considering the best course to adopt for bringing the far-reaching issues involved under the attention of the Government, with a view to some immediate measures of relief being obtained. This Conference will be held in the Lecture Theatre of the Institution of Electrical Engineers (Victoria Embankment) this afternoon at three o'clock.

Some Notes from Germany.—We hear from a Danish correspondent who formerly did much business with Germany, that for the last three or four months practically every machine shop in Germany has been busy turning out war material day and night; and this applies to practically every class of works; for instance, a large telephone factory is busy employed in this way. All the lathes available in Scandinavia have been bought up for Germany, and the large firms are putting in all they can get. Export to Denmark is diminishing week by week, not only for the above reason, but also because the supplies of raw material (especially indiarubber and all metals except zinc) are getting smaller. Electrical goods may only be exported if they do not contain more than a trifle of copper or brass, and prices are about 20 per cent. over normal conditions. The two exceptions are lamps and technical china, which can be obtained at normal prices and quickly—doubtless due to the stoppage of export to Great Britain.

AN INDICATOR FOR DETECTING SHORTS ON TRAMWAY FEEDERS

By George G. Braid, A.M.Inst.C.E.

WHEN a short occurs on a tramway line, the feeder-breaker controlling the section in question opens automatically. As a rule, the only method of determining whether the short is still on the feeder or not is to replace the feeder-breaker, and then, if the feeder-breaker comes out again twice in succession, to presume that the short is due to some permanent defect, such as a breakdown in the overhead trolley-line construction. The repair tower wagon is then sent out to the feeding point so as to locate the exact position and cause of the fault. Now the fault may not be a permanent one; it may be due to the pole of a car getting temporarily entangled with the overhead line, or due to a telephone or other overhead wire falling on to the trolley wires, which might easily be pulled clear in a few minutes. It would then be quite safe for the feeder-breaker to be closed again, and thus as little delay as possible caused to the traffic.

Now it was to enable the attendant in the power station to know when the short was cleared that the writer designed the following short-indicator. The problem was to design an indicator which would distinguish between a low short-resistance of, say, 4 ohms, and a resistance of the nature of

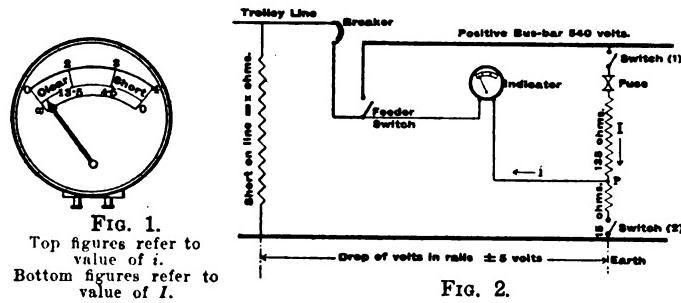


FIG. 1.
Top figures refer to
value of i .
Bottom figures refer to
value of I .

FIG. 2.

14 ohms, due to all the cars on the section having their lamp-circuits switched on. While indicating such low resistances the arrangement must not be so sensitive as to be seriously affected by a voltage of, say, 5 volts (positive or negative) existing in the rails due to the large return currents flowing in them.

The front of the indicator is shown in Fig. 1. When the resistance of the line to earth is above 13.5 ohms, the needle indicates "clear"; when the resistance of the line to earth is less than 4.5 ohms, a "short" is indicated. The principle of action of the instrument is shown in Fig. 2. The instrument itself is really an ammeter reading from 0 to 4 amperes, and combined with the instrument is a resistance of 150 ohms with a tapping at the point P . Table I. gives the values of the current through an indicator for various values of the short-resistance, and also shows the effect of the drop of potential in the rails.

| Resistance of Short to Earth. | Total Resistance R. | Total Current I. | Potential of P. V. | Current through Indicator i. | Maximum Effect of Rail Drop on i. |
|-------------------------------|---------------------|------------------|--------------------|------------------------------|-----------------------------------|
| 0 | 135.00 | 4.00 | 0.0 | 4.00 | ±0.38 |
| 5 | 138.75 | 3.89 | 14.6 | 2.92 | ±0.25 |
| 10 | 141.00 | 3.83 | 23.1 | 2.30 | ±0.20 |
| 15 | 142.50 | 3.79 | 28.4 | 1.90 | ±0.17 |
| > 15 | > 142.5, < 150 | < 3.79, > 3.60 | > 28.4, < 54.0 | < 1.90 | ±0.17 |
| ∞ | 150.00 | 3.60 | 54.0 | 0.00 | ±0.00 |

Whenever a short occurs, bringing out a breaker, the indicator is immediately connected up as shown in Fig. 2. Switches 1 and 2 are then closed. Of course, so long as the controllers of the cars are "on," an apparent short is indicated, but as the drivers will only put them on to try if the power is on, and then switch them off again, no permanent short will be indicated in this way. If the indicator shows "clear," it is best first to open switch 2 for a moment so as to throw a considerable voltage on to the line in case the fault is due to a guard or other wire hanging down and lying lightly against the trolley wire and making bad contact. As a rule, whenever switch 2 is opened, the guard wire will become partially fused to the trolley wire, and thus a short be immediately indicated whenever 2 is closed again. If, however, the indicator still shows "clear," it may be taken as an indication that it is quite safe to replace the breaker and switch controlling the section.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

ELECTRIC POWER IN THE RAND

A LONG and detailed Paper on the power supply of the Central Mining-Rand Mines Group was read by Mr. J. H. Rider at the London meeting of the Institution of Electrical Engineers on April 15th, having been read at Manchester and Birmingham on the two previous nights.

The group of mines in question is supplied with power by the Victoria Falls & Transvaal Power Co. and its associated company, the Rand Mines Power Supply Co., whose power stations at Rossherville and Vereeniging, were described in Mr. A. E. Hadley's Paper before the Institution in March, 1913 (see ELECTRICAL ENGINEERING, Vol. IX., p. 159, March 20th, 1913). The mines are thirteen in number, under control of the Central Mining & Investment Co. (formerly H. Eckstein & Co.) and Rand Mines, Ltd., and produce about 14·5 per cent. of the total gold output of the world's crushing, nearly nine million tons of ore per annum. A part of the power supply is in the form of compressed air from the Robinson Central Deep compressing station (also described in Mr. Hadley's Paper). The supply of power was started under the present contracts in 1911, and during the first three years some degree of trouble and interruptions were experienced until the full amount (25 per cent.) of reserve plant was available. It has been found that the maximum individual demands of the mines have a diversity factor of about 1·14, and the annual consumption is about 310 million units, with a maximum demand of 47,300 kw., or a load factor of about 75 per cent. The supply is furnished nominally at 2,100 and 525 volts 50 cycles three-phase, but the contract allows of a pressure variation of 10 per cent. up and down, and a frequency variation of 5 per cent. up and down before damages become due. Transforming plant is provided at each mine by the Power Co., who are bound to keep a spare transformer at each of the twenty-three points of supply. The capacity of the transformer stations aggregates 125,750 k.v.a. The electric supply is metered at each point of delivery by three meters in series—one meter is the property of the Power Co., another of the consumer, and the third is jointly owned and maintained. Normally the mean of the three is taken, but if any one meter reading is 3 per cent. different from the mean, the meter is tested and re-adjusted. The Paper also describes the means adopted for metering the compressed air supply.

The number of motors installed is 1,500, varying in size from 2 to 2,000 h.p., aggregating 142,300 h.p. Among the various uses, winding includes 57,340 h.p.; pumps, 30,330 h.p.; stamps, 13,800 h.p.; compressors, 11,700 h.p.; and tube mills, 10,170 h.p., distributed over the various mines. The electric winders are sixty-nine in number, fifteen underground and the rest on the surface. The nine largest are on the Ward-Leonard system, and the remainder three-phase. The deepest vertical shaft is 4,144 ft., and there are some inclined shafts of great length. A considerable proportion of the winders are old steam winders, with their connecting rods removed and motors connected up, and the three-phase system was largely adopted by those originally responsible on the score of saving in capital expenditure—a policy questioned by the author of the Paper. He admits that the three-phase control gear is simpler, but its handling is more arduous and less easy than that of the Ward-Leonard system. Again, the latter system is much more economical in working, in that braking requires no energy from the line, and will even return energy to the line, whereas with a three-phase winder, electric braking can practically only be obtained by using either reverse current or an auxiliary braking machine. Some of the winders are fitted with eddy-current brakes, each consisting of a field magnet system, exactly similar to that of a low-speed alternator, revolving within a hollow water-cooled cast-iron stator ring, with a smooth face. These are excited by motor-generators with field control. These brakes can lower an unbalanced load of 9,000 lb. at a speed of 250 ft. per minute with an expenditure of 45 kw. An equivalent result could only be attained by applying reverse current to the winding motor with an expenditure of 1,600 kw. These eddy-current brakes, however, bring the cost of the

equipment practically up to that of the Ward-Leonard system. Reverse-current braking is used on some of the three-phase winders, but it was not until after considerable experiment that satisfactory control gear was evolved.

The three-phase winders were originally controlled by liquid rheostats of German make of the variable weir type, with the liquid constantly circulated by a pump, but these gave considerable trouble in flashing over between electrodes and in other ways, and were afterwards replaced by metallic resistances controlled by a contactor system giving automatic acceleration control, and with contactor switches also in the stator circuits. This gear, which was supplied by the General Electric Co. of America, gave great satisfaction in ease of control, freedom from possibility of flashing over, and lower resistance in the full-load position. The only changes that were found necessary in this apparatus was its re-erection on a more substantial framework, and the substitution for the original cast-iron grids under water of a series of air-cooled rods or tubes for the main portion of the motor resistance, and three iron plates in water for the remainder. The contactors for the stator circuits have arcing horns and magnetic blow-outs, and are much better adapted to the very frequent operation required than oil switches, and have been recorded to have made and broken the stator circuits over 388,000 times without any cost for repairs or maintenance. It is stated generally that the deeper the shaft, the cheaper is the three-phase system relating to the Ward-Leonard system up to the point where the weight of the descending rope balances the ascending load, and reverse current has to be applied to prevent the winder running away. The largest winder on the system, and indeed the largest in South Africa, is of the Ward-Leonard type, with two motors rated at 2,000 h.p. direct coupled to 22-ft. drums, and capable of raising a net load of 16,000 lb. from a depth of 3,540 ft. at 3,500 ft. per minute.

The conditions of winding are somewhat different from those obtaining in coal mines, and there is very little headroom above the point where the skips in which the ore is raised are tipped. Experience has shown, however, that most of the so-called over-winding accidents have not been caused by any failure to stop the skip in time, but by starting the wrong direction inadvertently. Overwinding devices which cut off the supply are not of great use in such circumstances, because the driver must retain full control to be able to bring the skip to the exact tipping point. An apparatus devised by Mr. W. Philip (of the Simmer and Jack East Mine) is, however, used, in which suitable contacts are provided on the indicators, control levers, &c., which cause a hooter to sound immediately if the control lever is moved in the wrong direction while the skip is in the danger zone. A special form of dial depth indicator, in which the pointer moves through a very wide angle, covering at least $1\frac{1}{4}$ turns in a circular path of increasing radius. All the electrical instruments and pressure gauges are mounted on the same framework as the indicator dials.

The whole of the pumping is now electrically worked. Originally it was done by steam and compressed air driven pumps in stages until high-lift motor-driven ram pumps were installed. Some of these have now been superseded by multi-stage centrifugal pumps. The most notable installations consist of two eight-stage Sulzer pumps in series coupled on either side of a 500-h.p. motor running at 1,470 r.p.m., and capable of lifting 375 gals. per minute to a height of 2,400 ft. With these pumps a considerable reduction of working costs as against the ram pumps has been experienced, and the use of such plant is being extended. The pump motors at the very lowest levels which are liable to be drowned out will be worked at 200 volts from step-down transformers, and, being of the squirrel-cage type, will have no switchgear between the transformers and the motors. They will be started by star-delta connection of the transformer primaries.

After the ore is tipped into the headgear bins, it is rough-sorted on long picking belts and passed to crushers of the jaw or rotary type, in which it is crushed to pieces in $1\frac{1}{4}$ in. cubes and smaller. A feature in the driving of these crushers is that, owing to dust difficulties, the motors are placed in

separate houses. The ore is then taken to the stamp mills, where it is reduced to finer particles. The rows of stamps consist of weighted rods raised by cams on a shaft running along the row, and are allowed to drop by their own weight. The cam-shafts are driven at 49 r.p.m. by a double-reduction belt drive with jockey pulleys. The power required is about 5 h.p. per stamp. In the older stamps one large motor drives from 80 to 100 stamps, but in the later installation a separate motor is provided for each group of 10 stamps. It is important to note that if the shaft speed increases above a certain value, the uprising cam may meet the descending tappet before it has completed its fall, and a "camming" action will result that may break the shaft. In the earlier days the variation of frequency caused a good deal of trouble due to this cause, which affected all the mills at the same time. It was noticed that the supply was more generally given near the higher limit of frequency, and the drives were altered to suit, as being the lesser evil.

From the stamps, the ore passes to the tube mills, where it is further pulverised. These are cylindrical vessels about 22 ft. long and 5 ft. 6 in. diameter, carried on hollow trunnions and rotated at 28 r.p.m. They take a considerable amount of energy to start, and are very sensitive to over-loading; as many of the motors have burned out from these causes, the original 100-h.p. motors are being replaced by 125 and 150 h.p. machines. After various experiments, the most satisfactory form of drive was found to be a motor running at 585 r.p.m. belted to a pulley on a pinion shaft running at 120 r.p.m. and straight-toothed spur-gearing of 4:3 to 1 ratio.

Certain of the mines which are too far distant from the Power Co.'s compressing station to take compressed air in bulk have their own electrically-driven compressors. Some are converted horizontal steam-driven compressors rope-driven by motors, and with one exception the new direct-coupled compressors are of the Belliss vertical two-stage pattern, some as large as 1,000 h.p. There is also one Parsons turbo-compressor, which compresses air to 7.5 lb. per sq. in., at which pressure the old rope-driven machines complete the compression.

Electric power is also used for underground haulage and locomotives (5,290 h.p.), workshops (2,110 h.p.), ventilating (1,370 h.p.), and other miscellaneous purposes (4,750 h.p.). As a rule, motors up to 50 h.p. are on the 525-volt circuit, and larger ones wound for 2,100 volts. At present squirrel-cage machines are only used below 15 h.p., but their use is being extended to much larger sizes, with auto-transformer starters. The slip-ring motors, as a rule, have liquid starters.

The switchgear which deals with the distribution of the 2,100 and 525 volts has undergone considerable modification from its original form, as, especially from the point of view of safety, it left much to be desired. A proper cubicle system is now employed, and the oil switches, instead of being rated merely on the full-load current of their circuits as formerly, are now all of a standard size rated at 800 amperes at 15,000 volts, whether they are on the 2,100- or 525-volt circuits. Three-core lead-covered cables laid in trenches are used universally between the main switchhouses and the sub-distribution points on each mine.

The latter part of the Paper deals in some detail with causes of trouble due to faults in design and manufacture in some of the plant supplied, and in particular the smallness of the air-gaps and lack of rigidity of the frames of the large three-phase winding motors is mentioned. A minimum radial air-gap of the following value is now demanded for all moderate-speed motors :—

$$\sqrt{d} - 0.25 \text{ mm.}, \text{ where } d = \text{rotor diameter.}$$

An interesting point is the difference in the temperature-rise of machines at the altitude of the Witwatersrand (about 6,000 ft.) compared with sea-level. For this reason it is specified that no part of the motor shall have a temperature-rise exceeding 30° C. on full-load continuous test at sea-level (with an atmospheric temperature of 25° C.), as this corresponds approximately to a temperature-rise of 35° C. at 6,000 ft. altitude (with an atmospheric temperature of 35° C.). Finally, some details are given of the use of compressed air in the mines, which is chiefly used underground for rock drills, small winches, and blowing out the workings after blasting has taken place.

The author concludes with a tribute to the work of his predecessor, Mr. A. M. Robeson, and expresses his thanks amongst others to Mr. E. G. Izod, who succeeded him as Consulting Electrical and Mechanical Engineer to the Central Mining-Rand Mines Group.

The discussion was opened by Mr. A. E. Hadley (Managing Director, Victoria Falls Power Co.), who said that such early

troubles as had been experienced were entirely due to the shortage of spare plant, which had since been remedied. The wide limits of variation of voltage and frequency were accounted for partly by this cause and partly by the nature of the consumers' plant. He paid a high tribute to the way in which Mr. Rider had carried on the negotiations with the Power Company.

Mr. J. Shepherd (L.C.C. Tramways) referred to the enormous size of the undertaking, the power taken by which was greater than the whole of the units generated by the companies and municipalities in London. He asked if Mr. Rider really thought that 25 per cent. reserve plant was sufficient when turbogenerators were employed. The allowable pressure variation of 10 per cent. up or down he regarded as excessive. He questioned whether the three-phase winders were really reliable without the addition of the eddy-current brakes, and submitted that this addition brought their cost nearly up to that of the Ward-Leonard system without the advantage of regeneration of energy. He thought that the control gear in the winding motors described in the Paper appeared rather small for the voltage and for the work it had to do. He was surprised that more trouble had not been experienced from dust. He also suggested that worm driving might have been employed for the tube mills, and asked what was the effect on the heating of the motors of the rarefied nature of the atmosphere due to the altitude.

Mr. C. P. Sparks (Chief Engineer, County of London Electric Supply Co.) observed that for the very largest winders the Ward-Leonard system had been employed, which confirmed his view that there were difficulties in the way of control gear for very large three-phase winders. The contactor system seemed admirable, and among its advantages over the liquid resistance system was the more complete way in which the resistance could be short-circuited. He was inclined to regard the power taken for ventilation rather small, considering the extent of the mine, and enlarged upon the influence of good ventilation on efficiency of labour in mines. He considered the range of variation of pressure and frequency extraordinarily wide. It was evident, however, that they could not have been taken advantage of to any great extent by the Power Company, or so good a load factor could not have been obtained.

Mr. F. V. Hunter (Newcastle-on-Tyne Electric Supply Co.) expressed approval of the standardised oil switches described by the author, and asked if specially strong tanks were employed. He also wished to know whether complete sets of instrument transformers were provided with each of the three meters in each group. He thought that the Paper emphasised the important lesson that on large schemes it did not pay to put in cheap plant.

Mr. Roger T. Smith (Electrical Engineer, Great Western Railway) made some remarks on the system of metering, and pointed out that it was an advantage to have the different meters of different types, so that their errors, especially those due to temperature, might cancel out. He also asked if the drum type of liquid resistance had been tried, and referred to slip rings as being the part of an induction motor which gave most trouble. Contactor control was quite worth while, even with moderate-sized motors, and one of its advantages was the possibility of automatic acceleration. A tube of resistance that might perhaps be used was that composed of iron tubes with water circulating through them.

Dr. A. H. Railing (General Electric Co., Ltd.), in reply to a complaint of the author that manufacturers did not study the requirements of their customers sufficiently, assured him that of late years this had been to a large extent remedied by the employment of trained engineers to do work for which commercial men were formerly considered sufficient. Mr. R. Hammond spoke of the great advantage of the class of load in question owing to its excellent diversity factor, and Mr. L. B. Atkinson made some remarks on the financial part of the undertaking, which provoked a reply from Mr. E. J. Fox. The Chairman, however, ruled that these matters were somewhat outside the scope of the Paper. Another speaker was Mr. J. J. Fasola, who commented on the control gear of the winding plant and other matters.

Mr. Rider, in reply, said that he thought that 25 per cent. reserve plant was quite sufficient, and remarked that most of their troubles had occurred before as much as this had been provided. The three-phase winders with eddy-current brakes had proved quite reliable, since the control gear had been altered. The Ward-Leonard system was always a little more reliable in that it did not depend on its mechanical brakes in the same way in case of failure of supply. There had never been any trouble with those hoists that were specially constructed for electrical working, and the contactor gear had been quite satisfactory in its working, and the dry climate had been in favour of the insulation of all the apparatus. Worm gear was not well adapted to the driving of the tube mills, on account of the amount of end play necessary. In reply to Mr. Sparks' remarks on ventilation, owing to the different nature of the mines and large amount of compressed air used, as much power was not required for the purpose as in coal mines. A complete set of instrument transformers was provided for each meter, but there was not a great difference in the types of meter employed. He had not tried water-cooled tube resistances, but anticipated that they would give trouble in insulating.

THE DANGER OF IGNITION FROM MINING BELLS

THE Home Office has issued a report by Dr. R. V. Wheeler (of the Home Office Experimental Station, Eskmeals) on battery bell signalling systems as regard the danger of ignition of firedamp-air mixtures by the break flash at the signal wires. It will be remembered that Dr. Wheeler made some investigations on this subject in connection with the Senghenydd disaster, which were referred to in the official report (see ELECTRICAL ENGINEERING, Vol. X., p. 251, May 7th, 1914). Further experiments have since been made which had as their object the obtaining of a system of bare wire signalling which would be entirely free from the possibility of ignition.

The new experiments fully confirm the results of the earlier investigation. The most sensitive mixtures of methane and air are found to be those containing from 7·5 to 9·0 per cent. of methane, and the upper and lower limits of inflammability are 5·6 and 14·8 per cent. Experiments made with mixture diluted with nitrogen to represent the conditions often prevalent in mines showed that the ignitability of the mixtures is appreciably diminished by the addition of nitrogen, and it may be concluded that the firedamps of different mines will vary slightly in their susceptibility to ignition by sparks.

The next point investigated was the effect of the self-induction of the circuit. Sample coils of various inductances were experimented with, and it was seen that the amount of current required for the ignition of any of the mixtures tried increases rapidly so soon as the self-induction falls below 0·03 henry. For example, at 90 volts for self-induction of 0·00815, 0·03175, 0·06350, and 0·09510 henries respectively the currents required for ignition of an 8 per cent. mixture were 0·94, 0·42, 0·26, and 0·19 ampere. The amount of current in the circuit is of far greater importance than the voltage, especially with highly inductive circuits. Thus an 8 per cent. methane-air mixture is ignited by the break flash with a current of from 0·24 to 0·25 ampere at any voltage between 10 and 30 with a self-induction of 0·095 henry. On the other hand, at a given voltage quite a small change in the amount of current is sufficient to determine whether the flash is capable or incapable of igniting a given mixture.

A number of bells were experimented with, and the following conclusions were arrived at:—

All the bells examined were capable of producing a highly-dangerous break-flash at the signal wires when used with a battery of ten wet Leclanché cells, the voltage being 15. The break-flash was still more dangerous when a battery of ten dry cells was employed, since the current available from them is considerably greater than that obtainable from wet Leclanché cells. In general, the bells examined were "overpowered." A single bobbin with a reduced number of layers of wire was found in several cases, when fitted to the original bell-frame, to actuate the bell as efficiently as is required in practice. The use of only one bobbin with a small number of layers of winding reduces the self-induction of the circuit and thereby decreases the danger of the break-flash at the signal wires.

Inasmuch as the current voltage is relatively of little importance compared with that of the current strength, so far as the safety of the break-flash on the signal wires is concerned, it is desirable that attention should be directed towards not exceeding a certain maximum number of cells in the battery, rather than that care should be taken not to exceed a certain voltage. Moreover, it is desirable that a cell of comparatively high internal resistance, such as the wet Leclanché cell, should be employed, so as to avoid the possibility of obtaining large currents on short-circuiting the battery.

Taking as a standard battery ten wet Leclanché cells, quart size, such as are commonly used for battery-bell signalling systems, giving a voltage of 15 and a maximum current on short-circuiting of about 1·5 amperes, it is possible so to modify the usual pattern of bell as to render the break-flash at the signal wires safe in the most sensitive methane-air mixture, without impairing the ringing power of the bell. This can be done in several ways, of which the simplest probably are:—(1) By the introduction of a non-inductively wound resistance coil in series with the magnet coils such that it will reduce the current available at the break-flash below the minimum igniting current. (2) By increasing the resistance of the magnet windings of the bell by the use of wire of fairly high resistance, such as brass wire, for the same purpose. (3) By the use of an additional short-circuited secondary winding. (4) By the use of tinfoil strips between the layers

of winding. Of these four methods the third may be open to the objection that should the short-circuited winding be accidentally broken the bell might become unsafe.

No experiments were made as to the igniting power of the maintained spark at the trembler of the bell, for it was apparent from the bells examined that the provision of an adequate flame-tight casing, affording complete security against ignition of a firedamp-air mixture at the trembler of the bell, was not a difficult matter.

ELECTRIC MINERS' LAMPS

THE Home Office, in an Order (No. 249) dated March 16th, has approved of the three makes of electric miners' lamps mentioned below:—

The Pearson Lamp, made by G. Pearson & Sons, Ltd. (Abbott Road, Poplar, E.). This has a steel case, a cover provided with a flame-tight bayonet joint, a magnetic lock, a well protecting glass with rubber cushions, and a special bayonet joint lamp-holder, of which the upper part is easily removable to replace the bulb. The battery has spring terminals, and also rests on a spring at the bottom of the case. The lamp weighs 4½ lbs. complete.

The Wornshop Lamp, made by Wornshop & Co., Ltd. (Halifax). This has a steel case, with stamped steel cover fitted with a double magnetic lock, and a cylindrical protecting glass. The crown of the lamp, to which four pillars are riveted, consists of a ring of steel, the underside of which is recessed to hold a circular lens or steel disc and metal reflector, and to form the upper seating of the protecting glass. The pillars attached to the crown pass through holes in the bulb carrier plate and slots cut in the cover, and are secured to a flanged metal ring by nuts on the underside. The flanged metal ring carries an insulated disc fitted with switch contacts, and makes a flame-tight joint with the cover. The protecting glass makes a flame-tight joint with the crown and bulb carrier plate by means of asbestos or other suitable washers. This lamp weighs 5 lbs. complete.

The Rothwell Lamp, made by J. H. Rothwell & Co. (Swinton, Manchester). The principal constructive feature is a cover forming a flame-tight connection with the case, and consisting of a middle base ring of brass or steel carrying an aluminium or steel crown supported by four or more brass or steel pillars. The middle base ring is screw-threaded internally to take a celluloid glass-retaining plate. A stout protecting glass forms flame-tight connections with the crown and retaining plate by washers of asbestos or other suitable material. The glass-retaining plate also carries the lamp-holder and an insulated electrical contact piece. This lamp weighs 5½ lbs.

All the above lamps maintain a light of 1 c.p. all round in a horizontal plane for not less than 9 hours, and also a light of not less than 1·5 c.p. over an arc of 45 degs. in a horizontal plane.

The following addition to the official description of the "Ceag" lamp has been made:—

As an additional safety device, a fuse arrangement may be fitted through which the current from the battery will be short-circuited should the spiral spring that holds the bulb in position become displaced (by fracture of the protecting glass, for example). When this fuse, which is enclosed in a flame-tight space, is melted, the electric current through the lamp cannot be re-established until a new fuse has been inserted.

ELECTRO-METALLURGICAL PATENTS OF APRIL

IN Specification No. 14,192 of 1914 E. F. Côte and P. R. Pierron describe a process of zinc purification consisting in smelting the ores in one electric furnace and refining the product in another. In this process the zinc vapour is freed from the gases coming from the smelting bed and condensed into drops or powder, and submitted in the second furnace to redistillation. The metal is thus refined as it is produced while still at a temperature near that of volatilisation.

In Specification No. 23,495 of 1914 G. Gmür Zehnder describes an electric resistance furnace for dealing with refractory materials, in which an inner heating tube enclosing the material under treatment is itself surrounded by an outer tube also carrying current, so that external loss of heat is prevented and the tube and its contents are protected from oxidation.

ELECTRIC WINDING PLANT AT BURLEY COLLERY

AN interesting electrical colliery equipment is that of the Burley Colliery of the Midland Coal, Coke & Iron Co., Ltd., where extensive use is made of power generated from coke-oven and blast-furnace gases. The power-house for this purpose contains three 375-kw. "Witton" alternators driven by vertical four-crank tandem "National" gas engines, and

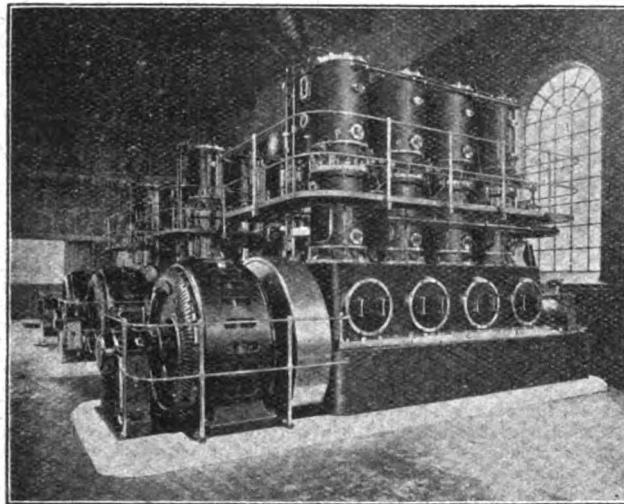


FIG. 1.—GAS-DRIVEN 375-kw. ALTERNATORS.

generating three-phase power at 550 volts, 25 cycles, and a 160-kw. steam-driven "Witton" generator with the necessary switchgear. The gas-driven sets are seen in Fig. 1.

The most interesting item of the motor-driven plant is the electrically-operated winder. This winder, which is shown in Fig. 2, is situated at the Burley Pit, the Company closing down their Sladdehill Pit as far as coal-winding is concerned, the coal from the latter being brought up by way of the upcast shaft of the Burley Pit. The winding drum is of the double-cone type, from 7 ft. to 18 ft. in diameter, and 11 ft. 8 in. wide over the flanges. The brakes are of the double-post type, lined with wood blocks, worked by a foot-lever during normal working. For emergencies a vertical lever fitted with overwinding attachment operates a trip gear, which, releasing a weighted lever controlled by a dashpot, gradually applies the emergency brake. A failure of the current supply also brings into operation a solenoid, which

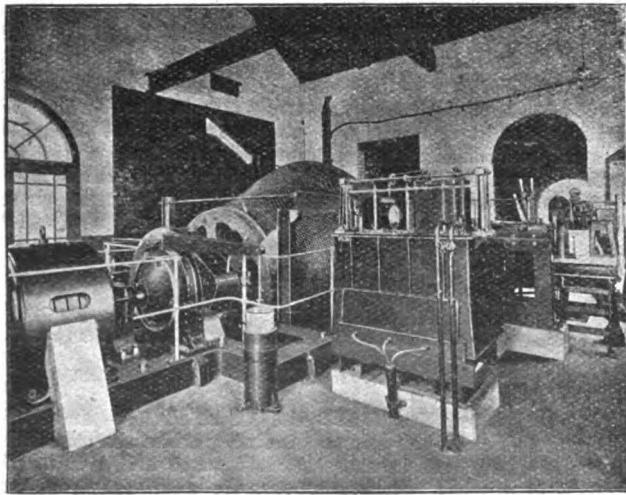


FIG. 2.—THREE-PHASE WINDER AT BURLEY COLLERY.

will apply the brake, and, in addition, a hand lever is provided by which the operator can apply the brake when desired. The trip lever in operating cuts out the motor by means of an emergency switch. To replace the emergency brake after an application, a small hand-wheel is provided on the driver's platform. The drum is driven by a 145-b.h.p. "Witton" motor (continuous rating), specially designed for heavy overloads. This motor runs at 240 r.p.m., and is geared to the drum shaft through single reduction gear running in an oil bath, and giving a drum speed of 39 r.p.m. The depth of the shaft is 458 yards, and the gross load of 30 cwt., or alternatively 12 men, is raised in 80 seconds. The winding

speed varies from 1,030 to 1,450 ft. per minute, and the h.p. at the end of the accelerating period—12·25 seconds after starting—is 179, dropping during the running period to 86 h.p. The retarding period is equal to the accelerating period.

The controller, of the liquid type, involves a new principle, avoiding the disadvantages of the rising and falling weir pattern, and is completely mistake-proof. It is arranged so that the operator cannot inadvertently accelerate or retard at any other than a predetermined rate. The main operating lever actuates both the reversing switches and the valve in the control tank. A special device preventing the stator switches being left partially in contact is provided. This also has a function of preventing the driver inching by rapidly switching on or off. There are three notches only for this lever, an off position and a full-on position for either direction. The regulating lever is situated outside the main control lever, and has a number of notches representing different speeds; it can be set for either full or for any fraction of full speed.

The winding gear is fully equipped with safety devices. There is a depth indicator of the vertical type driven from the drum shaft, and provided with an overwinding attachment, and an over-speed gear of the high-speed Hartnell governor type is also provided, and controls the speed of the cage at every point in the shaft. Should the driver fail to effect the necessary reduction in speed when nearing the end of the wind, the over-speed device, which is set to operate on a 5 per cent. speed increase, opens the motor circuit and applies the weighted brake lever. The resistance is cut out of the rotor circuit by the downward motion of three movable electrodes connected together to form the star point of the circuit, and these dippers are attached by a chain fastened over pulleys to a float in an entirely separate tank. When the float rises the dippers are lowered and cut out the resist-

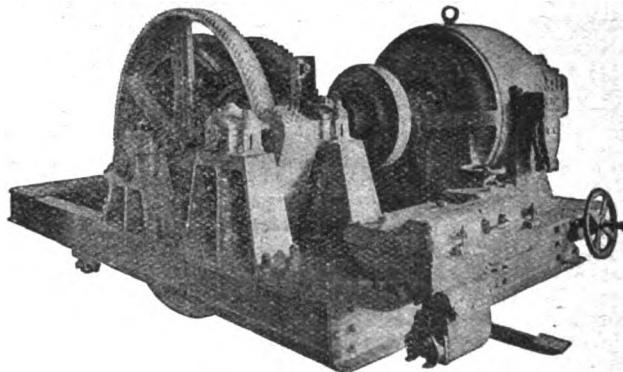


FIG. 3.—HAULAGE GEAR DRIVEN BY 100-H.P. PIPE-VENTILATED MOTOR.

ance, their movements in this way being delicately controlled. The float tank is constructed in two portions, an inner and outer tank, water being kept constantly in circulation from the outer to the inner one by means of a small motor-driven centrifugal pump. This water constantly flows from the inner tank unless the valve is closed by the control lever, when the level of the water rises at a predetermined rate, carrying with it the float, which thus lowers the dipper blades in the control tank and runs the motor up to the predetermined speed. The speed to which the motor accelerates is controlled by the position of a shutter forming one side of the inner tank, this shutter being itself controlled by a separate lever, which can, if desired, be placed permanently in any position, or alternatively can be used during each wind. If this second lever is put to the slow position, the motor will accelerate to the slow speed, when the main control lever, which is normally used by the driver, is put either in the forward or the reverse position. On the other hand, if the regulating lever is pushed into the full position, the motor runs up to full speed when the main lever is put over.

There are two stator switches, one for each direction of running, and these are so interlocked that they cannot both be put on at the same time. The rotor connections accommodate the fixed terminals in the starter tank. The power cost of raising coal from the full depth of the shaft by this gear is 0·5d. per ton. The electrical equipment was supplied by the General Electric Co., Ltd., of Witton, Birmingham, Messrs. M. B. Wild & Co., Ltd., of Nechells, Birmingham, being responsible for the mechanical portion of the winding gear.

Amongst the other electrical equipment of a colliery are a number of pumps, haulages, and so forth, driven by "Witton" motors. Among these attention may be called to the haulage shown in Fig. 3, which is of interest, inasmuch as the gear was constructed by the colliery engineers themselves. It is driven by a 100-h.p. pipe-ventilated "Witton" motor.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,441.

Are small continuous-current fan motors series or shunt wound, and why?

(Replies must be received not later than first post, Thursday, May 13th.)

ANSWERS TO No. 1,439.

What special precautions are needed in the design of porcelain bobbins for winding resistance wire for heating purposes and winding the wire thereon, and what current density can safely be used?

The first award (10s.) is given to "L. R." for the following reply:—

The basis of the design of porcelain insulators for the purpose mentioned should include reference to the following facts:—

The minimum thickness employed at any part should be $\frac{1}{8}$ in., so that the material is sufficiently strong notwithstanding the slight variations which always occur in the body of ordinary porcelain. In this connection it must be noted that the smallest section is more thoroughly baked than a larger section, and flaws are more frequently found in all large pieces of porcelain, and many times they are the determining factor in finding the strength. The lack of homogeneity in porcelain is a serious drawback. If glazed porcelain is used, this is about 25 per cent. stronger than unglazed in tension, but in compression the unglazed is the stronger, and generally employed. The glazing substance must be selected of a similar contraction coefficient to the porcelain upon which it is to be placed, and this is of particular importance as regards heaters, because the range of temperature is fairly great. The design must be such that the maximum working temperature of the porcelain does not exceed $1,500^{\circ}$ F. Porcelain does not fuse at this temperature; in fact, it requires about $2,750^{\circ}$ F. to fuse it, but it begins to conduct electrolytically at a temperature even as low as 400° F. The insulators must be so designed that even when stresses are set up due to heating, sufficient play is given that the following figures with a suitable factor of safety are not exceeded, viz., tensile stress 1,100 lb. per sq. in. unglazed, 1,400 glazed; compression strength 14,000 unglazed, 9,000 glazed.

The dielectric strength of porcelain is from 200 to 800 volts per mil., but this could almost be ignored in the design of heater bobbins, seeing that if sufficient material is given for mechanical strength, these figures will not be exceeded. In designing porcelain insulators, allowance must be made in the moulding instructions that 15 to 18 per cent. contraction occurs, and an experiment with the particular porcelain should be made, because often different contraction coefficients obtain in length, breadth, and height respectively. Further, porcelain for the above purpose should not be fired above $1,400^{\circ}$ to $1,450^{\circ}$ C. It is not the latest practice to wind wires for heaters exactly on bobbins, but rather to

provide supports for the porcelain at various parts, the design being such that the wire cannot sag. Also to assist the winding of the wire in a short space, coiled wires are used instead of straight wires. This is much better than winding straight wire on a bobbin.

A specification has just been published by Ferranti, Ltd., No. 17,945 of 1914, in which the insulator takes the form of a narrow bar with a single longitudinal ridge having two or more lateral projections at each side of the ridge, coiled wire being arranged between a series of such bars. For a 2,000-watt heater, 32 of these bars are used, the size being about 3 in. long and $4/5$ in. wide. The minimum thickness of porcelain is about 0'08 in., and this occurs where the metal rods on which the insulators are assembled pass through holes in the ends of the insulators.

In another arrangement coiled wire is wound backwards and forwards over a porcelain bar which has projections on it. The current density which can be used depends on the material employed and the temperature of working. With nichrome, which is a favourite material, a single 16 wire will take about 15 amperes to raise it to $1,000^{\circ}$ F., and 20 to $1,500^{\circ}$ F. This would require about 30 ft. in the first case, and 16 ft. in the second for the 110-volt heater. The total current density or capacity of the heater depends on its use; for a boiling plate 20 to 25 watts per sq. in. of surface is usual, a grill 15, an oven not more than 1,000 watts per cu. ft. capacity, and a room about 2 watts per cu. ft.

No second award is made.

ANSWER TO CORRESPONDENT

B. L.—The Dubilier high-frequency apparatus can be obtained from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.).

A.C. CRANE CONTROL

IT has become almost generally accepted that direct-current motors are so much more suitable for cranes than A.C. motors that it is worth while to go to some trouble to convert the current when A.C. supply only is available. In a Paper on foundry controllers, read before the American Institute of Electrical Engineers on April 15th, Mr. R. H. McLain discussed at some length the suitability of induction motors, and gave reasons for his opinion that the control could be so arranged as to make them suitable. A foundry crane differs from others by the requirement of a very uniform low value of creeping speed in the order of 1 ft. to 5 ft. per min. for certain operations, such as drawing patterns. Although 40 ft. per min. is usually chosen as the maximum hook speed, in some cases a speed as high as 60 ft. has been used; but even with the former speed it is difficult to use A.C. motors and control to obtain the low creeping speed mentioned from the same motor. In a crane intended for only one kind of work, however, it may be found on investigating the exact cycle of operation that a hook speed of, say, 12 ft. per min. would do just as much work per day as 40 ft. per min.

For maximum hook speeds up to 15 ft. per min. the author recommends ordinary rheostatic controllers, but above this, if A.C. is used, a large number of controller points are used and sufficient resistance to reduce the torque at starting to about 25 per cent. of the normal torque. Generally, he considers that A.C. will be successful if most of the creeping-speed work requires not less than 25 per cent. of the normal speed, and only a small proportion, 10 per cent., of the normal speed. Useful work at the latter speed, is however, dependent on the excellency of the "mechanical load brake," the solenoid brakes, and gearing. The mechanical load brake is described as an automatic friction-braking device, which not only holds back against the falling hook load, but also requires power from the motor to drive the load in a downward direction.

Manchester Local Section of the Institution of Electrical Engineers.—The annual report of this Section records the holding of twelve meetings during the past session. The total membership of all classes is now 732, a decrease over the figure for last year. The officers and Committee for the next session are as follows:—Chairman: B. Welbourn. Vice-Chairmen: C. J. Beaver, A. E. McKenzie. Committee: H. Alcock, C. Atchison, W. Cramp, Prof. A. B. Field, A. P. M. Fleming, S. L. Pearce, J. S. Peck, H. A. Ratcliff, J. A. Robertson, H. D. Symons, Ald. W. Walker, S. J. Watson. Past Chairmen: Prof. E. W. Marchant and P. P. Wheelwright. Hon. Secretary and Treasurer: J. Frith. Assistant Secretary and Treasurer: A. L. Green.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published April 29th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

136/14 and 3,221/14. Heaters. J. R. QUAIN. The first of these describes an immersion heater in which the wire is wound on a hollow support of silica and is contained in a cylindrical annular space between the support and a silica cover, fused on, so as to form a hermetically sealed chamber which can either be exhausted or filled with an inert gas. (Seven figures.) The latter describes a water heater of the geyser type, in which a large tubular heating element of the same construction is used. (Two figures.)

8,505/14. Arc Lamp Carbons. H. AYRTON. A copper-covered negative carbon, having a core consisting of a central carbon pencil surrounded by a packing composed of a material which burns away and leaves a space round the central carbon pencil for a certain distance from the tip. (One figure.)

14,577/14. Distribution Systems. B.T.-H. Co. (G.E. Co., U.S.A.). A method of obtaining a flexible voltage at the generating and receiving ends of a transmission line, which consists in holding the voltage at the receiving end at a definite value by regulating the power factor by synchronous boosters with automatically controlled excitation. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c. MYERS and MYERS [Conduit fittings] 18,277/14.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. Co. and SHUTTLEWORTH [A.C. commutator motors] 9,578/14.

Heating and Cooking: NEGUS and NEGUS [Ovens] 1,377/15.

Ignition: KELLER-DORIAN [Magneton] 8,931/14; NEWTON (Mosler) [Sparkling plugs] 16,308/14.

Incandescent Lamps: HIRSCH [Lamp casings] 17,889/13.

Switchgear, Fuses and Fittings: MARKS and HELSEL [Lamp-holders] 3,702/14; ANNAND [Plugs and sockets] 9,305/14;

ESKRIGÉ [Shade carriers] 9,659/14; JONES, WILSON and SHEPHERD [Control of fan motors] 9,726/14; BERAUD [Time switches] 17,986/14.

Telephony and Telegraphy: AUTOMATIC TELEPHONE MANUFACTURING CO. & NEWFORTH [Telephone systems] 27,533/13 and 1,969/14; BETULANDER AUTOMATIC TELEPHONE CO. and ATKEN [Impulse transmitters] 6,209/14; GRAHAM and RICKETS [Distant control of signals] 6,214/14; AUTOMATIC TELEPHONE MANUFACTURING CO., SPERRY and RAY [Telephone systems] 9,648/14; DIXON [Synchronising systems for multiplex telephony] 9,666/14; McGAURAN [Telephone-call recorders] 12,233/14; GIRARDEAU and BETHENOD [Spark gaps for wireless telegraphy] 15,031/14; THOMPSON [Perforators] 21,090/14.

Traction: SOC. ANON. DITE S.T.A.R. (*Système de Traction Auto Réglatrice*) [Motor control] 15,155/14; THOMPSON [Electromagnetic perforators] 21,090/14.

Miscellaneous: TOKALON, LTD., and PRATT [Electric hair brushes, &c.] 4,908/14; HAMMOND [Control of torpedoes, &c., from a distance] 6,171/14; CLAUDE [Neon vacuum tubes] 2,020/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Instruments, Meters, &c.: BLATHY [Adjusting meters] 5,319/14.

Telephony and Telegraphy: TIGERSTEDT [Microphone] 5,174/14; GES. FÜR DRAHTLOSE TELEGRAPHIE [Wireless receiving apparatus] 5,342/14.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: CALENDAR'S CABLE & CONSTRUCTION CO., LTD. [Fuse and junction boxes] 1,054/03.

DYNAMOS, MOTORS AND TRANSFORMERS: A. P. WOOD and LANCASTER DYNAMO & MOTOR CO. [Brush holders] 1,006/07.

Incandescent Lamps: B.T.-H. (A.E.G.) [Welding of filaments to supports] 814/07.

Storage Batteries: K. R. SMITH [Battery terminals] 1,034/07.

Switchgear, Fuses and Fittings: G. W. MASCORD [Controllers for printing press motors] 876/06.

Telephony and Telegraphy: W. D. KILROY [Order telegraphs] 1,229/02.

Traction: B.T.-H. CO. (G.E. CO., U.S.A.) [Control of petrol-electric vehicles] 930/06; E. M. MUNRO & RAILLESS ELECTRIC TRACTION CO. [Earthing of vehicle frames] 1,067/09.

ELECTRIC TRACTION NOTES

The *Electric Railway Journal* (New York) quotes statistics from Berlin to the effect that the loss of traffic on the Berlin tramways in the second half of 1914, as compared with 1913, was 15·1 per cent., notwithstanding that a large amount of omnibus traffic was diverted to them, for the corresponding diminution in omnibus traffic was 32·8 per cent., largely owing to withdrawal of vehicles for war service. The "Hochbahn," which in the first half of 1914 had carried 45·1 per cent. more passengers than in the first half of 1913, owing to the opening of the Wilmersdorf line, showed a decrease of 27·2 per cent. in the second half of 1914.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The total number of employees of the Post Office Engineering Department who are with the Army is now about 5,000, representing about 20 per cent. of the total number employed. It is expected that more men will gradually be released for special duty.

At the annual meeting of the Indo-European Telegraph Co. on Thursday, it was stated that the Indo route to India and beyond was totally interrupted in Germany on July 31st, 1914, without notice, i.e., before the declaration of war.

CATALOGUES, PAMPHLETS, &c., RECEIVED

FANS.—A very effective leaflet dealing with fans has been produced by the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), and can be overprinted with contractors' names and addresses in quantities over 250. The cover has a charming view of a polar bear on an iceberg, and is inscribed, "Be cool this summer. Let's tell you how."

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC BELLS. A folder from the Electrical Supplies Co. (53 Victoria Street, Westminster, S.W.), gives particulars of the British-made electric bells which they are placing on the market. These bells are made in London factory, and large stocks are held for immediate delivery.

MOTORS.—A very convenient little pocket note-book is being issued by the Langdon-Davies Motor Co. (110 Cannon Street, E.C.), containing on the first few pages some useful tables, as well as particulars of the company's standard sizes of A.C. and D.C. motors.

Siemens' Employees in H.M. Forces.—A booklet has been issued by Siemens Brothers & Co., Ltd., and Siemens Brothers Dynamo Works, Ltd., giving the names of the employees of the two firms from the various works, offices, branches, &c., who are now serving in H.M. Forces. We are pleased to see that over 1,000 men have joined the Colours, and we understand that a number more have joined since the booklet was printed.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Sydney Council requires one or two 12,000-kw. turbo-alternators, with exciters, surface condensing plant, auxiliary plant, oil cooler, steam separator, &c. July 19th. Further particulars at 73 Basinghall Street, E.C.

Coventry.—Extensions are to be carried out to the switchboard, and the cost is to be met out of revenue.

Haslingden.—The L.G.B. has sanctioned loans of £4,600 for mains and £2,770 for services, transformers, and switch-gear.

Leeds.—Steam feed and water pipes for 18,000 kw. of plant. Borough Electrical Engineer. May 28th. (See advertisement on another page.)

Leigh.—One vertical tube boiler, one 250-kw. rotary converter or motor converter, and one switch panel. Borough Electrical Engineer. May 21st.

London: Battersea.—The Finance Committee of the L.C.C. recommends sanction to a loan of £9,000 for mains, house services, and meters.

Stepney.—The Finance Committee of the L.C.C. recommends sanction to a loan of £15,000 for mains, feeders, and general extensions.

Woolwich.—The Finance Committee of the L.C.C. recommends sanction to a loan of £35,000 for new plant at the Globe Lane power station. This plant is required in connection with Government contracts, but a condition attached to the sanction by the Treasury is that the outstanding balance on April 1st, 1920, in respect of loans originally granted for forty-two years for existing plant shall be repaid in half the period unexpired on that date. In reporting upon this scheme the Finance Committee reiterates the opinion expressed some time ago that the Council would have been wiser to have adopted a partial bulk supply scheme in preference to extending the Globe Lane station, but the Committee does not feel justified in pressing the Borough Council to reconsider its decision. By the scheme now adopted, Sir John Snell, whom the Borough Council has consulted, states that the net loss on the undertaking will be reduced from £16,000 to £9,561.

Manchester.—Crane, conveying plant, &c., for Barton power-house. Chief Electrical Engineer. June 2nd. (See an advertisement on another page.)

Todmorden.—The L.G.B. has informed the Council that it cannot consent to the proposed loans of £1,000 for mains and £200 for motors unless they are required for works on account of war requirements.

York.—The Corporation has decided that the extension of electric mains to Strensall, Poppleton, and Naburn, and the erection of cooling tanks at the electricity works are imperative, and that their abandonment would involve heavy financial loss to the city.

Wiring

Edinburgh.—Waste Paper Buildings, Powderhall, Broughton Road. City Electrical Engineer, Dewar Place. May 12th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Birmingham.—New post office. Surveyor, Birmingham P.O.

Cardiff.—Block of offices, 97-8 Bute Street. Architect, Henry Budgen, 95 St. Mary Street.

Chelmsford.—New offices for Prudential Assurance Co.

Ilford.—Carnegie Library (£6,000).

Kingston-on-Thames.—Elementary school.

Manchester.—New post office, Droylsden.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Aberdare.—The tender of Bruce Peebles & Co. for motor-converters and H.T. switchboard, feeder pillar, &c., has been accepted.

Croydon.—Two economisers having been condemned by the Insurance Co., the Electricity Committee recommends the

acceptance of a tender by E. Green & Co. for a new 384-tube economiser at £831.

Dublin.—The Electricity Supply Committee has received tenders for a supply of carbons for the street arc lamps. The best offer is by Messrs. Geipel & Co. at 12 guineas per thousand pairs for open-type arc lamps for twelve months, but without any guarantee of delivery. The firm is able to deliver immediately 40,000 pairs at £12 per thousand, and the Committee decided to make this purchase. The tender of C. W. Webster of Bingley, Yorks, for 20,000 pairs of 15-inch carbons at £8 10s. 1d. per thousand pairs, 15,000 pairs of 12-inch at £6 16s. 1d. per thousand pairs, and 20,000 pairs of 25½-inch at £2 18s. 9d. per thousand feet, has been accepted. These supplies, it is anticipated, will keep the street lighting adequately maintained until the end of October.

Dundee.—The successful tenderers for twelve months' supply of electrical stores were the Edison & Swan United Electric Light Co.

London: Hammersmith.—Messrs. Johnson & Phillips, whose tender was recently accepted for box frames, covers, boxes, &c., for 1915-16, have asked the Council to release them from their offer owing to the difficulty of supplying the goods in consequence of Government work, and their request has been granted. Messrs. W. Lucy & Co., the next lowest tenderers, are to be asked if they will accept the contract.

Manchester.—The following tenders have been accepted by the Electricity Committee:—Three 1,250-k.v.a. static transformers, British Westinghouse Co.; cable, W. T. Glover & Co., Union Cable Co., British Insulated & Helsby Cables, Callender's Cable & Construction Co., Johnson & Phillips, and Western Electric Co.; three 3-wire balancers, Lancashire Dynamo & Motor Co.; one 250-k.v.a. transformer, British Electric Transformer Co.; one 650-kw. rotary converter, British Westinghouse Co.; three 1,000-k.v.a. three-phase static transformers, Ferranti, Ltd.

The Mirrlees Watson Co. have recently received orders for condensing plant from the Torquay Corporation (third set); South Leicestershire Colliery Co. (two sets); Compagnie Française Thomson-Houston, Paris, for Tuiliere Power Station (fourth set), also for Athens Power Station (third set); and Tharsis Sulphur & Copper Co. (three sets). Orders have also been received for plant for Bourges (France), Senegal, Russia, Japan, Straits Settlements, and West Indies.

Messrs. Venner & Co. have received contracts for a twelve months' supply of Chamberlain & Hookham meters from the Maidenshead, South Shields, and Bradford Corporations.

Messrs. Ferranti, Ltd., have secured contracts for a twelve months' supply of meters to Belfast, Halifax, Heston & Isleworth, Swindon, Wimbledon, Grays, Grimsby, Birkenhead, Alloa, Liverpool, Kilmarnock, and Bradford.

Tyres for Electric Vehicles.—In view of a decision by the leading manufacturers of solid rubber tyres that such tyres will in future only be guaranteed for 10,000 miles within a period of 12 months, Edison Accumulators, Ltd. (2 and 3 Duke Street, S.W.), announce that their experience of the better wear of tyres on electric vehicles enables them to give a guarantee of 12,000 miles within 15 months for tyres sold by them with their electric vehicles.

Union Cable Co. and Government Contracts.—In answer to a question by Mr. Booth in the House of Commons on Thursday, Mr. Beck (Lord of the Treasury) said that a contract was recently given to the Union Cable Co. by the Government. He was aware, he added, that the principal holding in this company is in German hands. The Managing Director is an Englishman (Mr. Blackwood), and the other four directors are German. The action of the Office of Works in this matter is in accordance with the policy laid down, in common with other departments, by H.M. Government in the Trading with the Enemy Act. Mr. Booth pointed out that the other directors are Bernard Hirschman, Siegfried Hirschman, Julius Hirschman, and Moritz Kremer, and that the Deutsche Kabelwerke Allgemeine Gesellschaft of Berlin holds 48,218 shares out of a total of 50,000. Mr. Beck said the company's works were in Essex, and a number of English people were employed, and not a penny profit of any kind went to the German people.

Newcastle Electricians and the War.—A meeting of the electrical section of the Newcastle Chamber of Commerce was held last week, when it was unanimously resolved, states the *Newcastle Daily Journal*, that the members of the section would offer their individual help in their spare time to the Munitions of War Committee in any capacity; that each firm represented would state to the Munitions Committee what special work it was able to do and willing to do for the War Office or the Admiralty; and that the opinion of the Munitions of War Committee should be taken as to whether this committee should approach similar bodies and ask for promises of individual help, should it be required.

LOCAL NOTES

Aberdeen: Clerks as Switchboard Attendants.—Mr. J. A. Bell, the City Electrical Engineer, reports that twenty-seven of his staff are in the Army, and that seven men have been allowed to join since the winter load was over. To keep the works running it has been necessary to use the clerical department and to train the members as switchboard attendants.

Barking: L.G.B. and Proposed Loan.—In connection with an application for a loan of £18,000 for extensions at the Council's electricity works, the L.G.B. has stated that unless the proposed expenditure, or some part of it, is necessary for military purposes, the loan cannot be sanctioned at the present time. The Board offered to hold a local inquiry to ascertain to what extent the loan in question is required for military purposes, and the Council has asked for this.

Belfast: Re-organisation of Electricity Department.—The proposed scheme for re-organising the Electrical Department, on the basis that Mr. T. W. Bloxam, the City Electrical Engineer, resigned as a preliminary, was lost at the meeting of the Corporation on Monday by two votes. The matter has been temporarily abandoned until the Council can hold a meeting in Committee again.

Cleethorpes: Mains Extension Abandoned.—A scheme for spending £10,000 on mains extensions has been abandoned for the present owing to the attitude of the L.G.B.

Eccles: Wiring Inspection.—The Borough Electrical Engineer is preparing a report upon the desirability of asking the Home Office to place under the charge of their local inspectors of factories the duty of inspecting and approving wiring installations carried out by local wiremen.

Edinburgh: Electricity Deficit.—The estimates of the Electric Light Committee for the coming year show a deficit of £5,000, and the question of whether this is to be made up by increasing the charges or otherwise is now under consideration.

London: Woolwich: Increase in Charges.—The charges for electric supply are to be temporarily increased by $\frac{1}{2}$ d. per unit for lighting other than for factory use, and $\frac{1}{2}$ d. per unit for power consumers except those having agreements obtaining a coal clause. Power consumers are to be offered the option of a coal clause in their agreements in substitution of the extra charge.

Manchester: Increase in Charges.—The Electricity Committee has now formulated its definite recommendations with regard to the increases in charges for electric supply indicated in our last issue. The charges for domestic lighting, cooking, &c., are to be increased by 10 per cent.; industrial power charges by 15 per cent.; the rateable value system is to be increased from the fixed charge of $12\frac{1}{2}$ to 15 per cent., and the total charge on this basis, including the charge for current, is to be then increased by 10 per cent.

Rotherham: Electric Supply Accounts.—The report of the Borough Electrical Engineer shows that the financial results of the year to March 31st, 1915, fell below those of the previous twelve months, the gross profit being £2,201 less. The net profit, after providing for capital charges, is £4,786, or £2,572 less than in the previous year. The total cost of generation has increased from 0'651d. to 0'7d. per unit.

Yorkshire: Electricity Supply.—Following the rejection of the Yorkshire Electric Power Co.'s Bill, referred to in our last issue, the Councils of a number of districts in the Company's area are being asked to consider a joint municipal electricity scheme.

APPOINTMENTS AND PERSONAL NOTES

The Coventry Electric Light Committee recommends that the salary of Mr. G. Tough, the Electrical Engineer and Manager, be increased from £650 to £750 per annum.

Alderman Miller has resigned the Chairmanship of the Croydon Lighting and Electricity Committee, a post which he has held for eighteen years.

The Erith Electricity and Tramways Committee have decided to pay Mr. A. Coveney, the late Electrical Engineer, a month's salary, viz., £33 6s. 8d., in consideration of his services in a consulting capacity for two months after his resignation.

Mr. F. S. Grogan informs us that, after eight years' active work in connection with the "Tricity" cookers, he will very

shortly sever his connection with the British Electric Transformer Co., Ltd., in order to take up an appointment as manager of a new concern for the manufacture and sale of electric fires and cookers. In the meantime, any personal communications may be addressed to him at 14 Argyll Mansions, Beaufort Street, Chelsea, S.W.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £85 10s. to £86 10s. (last week, £87 to £88).

Increase in Prices.—G. St. John Day (Patents), Ltd. (Bank Mill, Morton Street, Oldham), announce that their prices are increased by 10 per cent.—The Benjamin Electric, Ltd. (1A Rosebery Avenue, E.C.), announce an increase of 10 per cent. in the greater part of their list prices.

Anglo-Portuguese Trade.—The Lisbon Chamber of Commerce has issued a circular relating to trade relations between Great Britain and Portugal containing proposals regarding giving effect to the recent treaty of navigation and commerce between the two countries, and giving a list of goods in which trade may be increased. Manufacturers and dealers are requested to send wholesale lists to the Representative, Lisbon Chamber of Commerce, 26 Exchange Street East, Liverpool.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Johnson & Phillips.—The net profit for 1914, after charging £7,000 for maintenance of buildings, plant, &c., was £37,119, in addition to £12,755 brought forward. After meeting debenture interest and transferring £8,158 to depreciation, a balance of £24,295 remains, from which a dividend of 5 per cent. for the year is recommended on the ordinary shares, carrying forward £15,545.

British Thomson-Houston Co.—The report for 1914 states that prior to the outbreak of war the Company was making excellent progress in all its departments, but in August and September the business was seriously disturbed. In a comparatively short time, however, satisfactory readjustments were made to cope with the new conditions, with the idea of doing as much work as possible to meet the requirements of the Government, and at the same time to carry out as far as reasonably possible obligations to other customers. Over 1,000 employees have joined the Colours. The Company has been manufacturing munitions of war at its various factories for months, and a large number of machine tools have been installed for this purpose. The net profit for the year was £87,107, and of this £73,309 have been set aside for depreciation, and the balance of £13,798 is carried forward.

Willans and Robinson.—The report for 1914 states that the Company is now largely concerned in Government work. There was a net profit of £17,058 after paying debenture interest and providing for depreciation and the upkeep of Queen's Ferry Works, which are now utilised by the Government.

South Wales Electrical Power Distribution Co.—Notwithstanding the dislocation of trade during the last five months of 1914, the Company's business shows an increase, the output being 698,167 units more than in the previous twelve months. The whole of the working expenses are borne by the Trefores Electrical Consumers Co., and the South Wales Co. shows a surplus, after meeting debenture stock and depreciation, of £5,347, compared with £2,915 in the previous year. The accumulated profits are now sufficient to deal with the indebtedness of £13,500 due to certain members of the Trefores Co. A new issue of capital will be necessary to deal with the expansion of the business.



ELECTRICAL ENGINEERING

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SUMMARY

A GREAT conference of the electrical and gas industries was held at the Institution of Electrical Engineers last week to frame some course of action in order to prevail upon the Government to facilitate coal supplies (p. 204).

MORE electrical engineers are still wanted for the Electrical Emergency Service—particularly men over military age—in certain districts of London (p. 204).

SOME additions have been made to the standardisation rules of the B.E.A.M.A., dealing with tolerances between guarantees and test results, parallel running of alternators, and other matters (p. 206).

A HOUSE of Lords Committee has given the Plymouth Corporation full municipal wiring powers, whilst a House of Commons Committee has insisted upon the Lincoln Corporation carrying out wiring through a contractor (p. 206).

THE calculation of the size of feeder cables is dealt with in our Questions and Answers columns (p. 207).

AMONG the subjects of specifications published last Thursday at the Patent Office were locking lamp-holders, plugs and sockets, A.C. motors, electric traction, and telephones for air craft (p. 208).

AN exhibition of articles of British manufacture in fields of industry where German competition has been seriously felt is in progress at the Agricultural Hall (p. 208).

A REFLECTOR fitting for half-watt lamps and a tramway section switch are described on p. 209.

AN automatic stoker is required at Dublin; mains and motors at Derby; cable at Southampton; new plant at Willesden; and a motor-generator and accessories by the Victorian Railway Commissioners.—The Waterford supply scheme is being proceeded with, and plant is required for a hydro-electric power station in Spain (p. 209).

THE Treasury has suggested that the L.C.C. should delay the installation of the two new turbo-generators at Greenwich.—War contracts are being delayed at Leigh (Lancs.) on account of the difficulty in obtaining L.G.B. sanction to a loan.—The Coventry electricity works had a record output last year.—Rapid progress is being made with the temporary Birmingham new power station (p. 210).

Arrangements for the Week.—(To-day) Thursday, May 13th.—Iron and Steel Institute, at Institution of Civil Engineers. Annual Meeting. 10.30 a.m.

Friday, May 14th.—Iron and Steel Institute. Annual Meeting. 10.30 a.m.

Physical Society of London, at Imperial College of Science, South Kensington. "On Electrically Maintained Vibrations," by S. Butterworth. 8 p.m.

Tuesday, May 18th.—Illuminating Engineering Society, at Royal Society of Arts. Discussion on "Some Points in Connection with the Lighting of Rifle Ranges." 8.15 p.m.

Obituary.—We regret to record the death, from a severe attack of pneumonia, of Mr. H. F. Friederichs, Borough Electrical Engineer at West Hartlepool. Mr. Friederichs, who was fifty years of age, had held this post since the Corporation undertaking commenced in 1889. It is only a short time ago that the success of his scheme for utilising the waste steam from the Seaton-Carew blast furnaces for the purpose of generating electricity was recorded. It will be remembered that Mr. Friederichs was in attendance at the electricity works during the bombardment of Hartlepool by the Germans in December, and under his direction supply was maintained throughout without interruption.

Finance and War Time.—In connection with the recent Treasury notice prohibiting the issue of new capital by joint stock companies during the war and for twelve months afterwards without consent, a Bill has been introduced into the House of Commons entitled "Statutory Companies (Redeemable Stock) Bill." This Bill enables parliamentary companies, including electric supply companies, to issue redeemable preference or debenture stock. These companies can at present only issue stock on war terms, and in many cases will have no power to redeem any stock so issued when normal conditions again prevail. The Bill is framed, therefore, to provide for the redemption of any stock so issued on such terms and conditions as may be specified in a resolution of the company. This only applies to stock authorised to be created or to be issued before the outbreak of the present war, or after the outbreak of the present war and before the coming into force of the new Bill. A point on this latter provision has been raised with regard to the private Bills now passing through Parliament, it being argued that several of them may receive Royal assent a day or two after the Government Bill, and therefore will be deprived of the advantages of it. The Bill has already passed the House of Commons, and the point in question is to be brought before the authorities of the House of Lords with a view to suggested amendment being carried out.

COAL SUPPLIES

Joint Conference of Electricity and Gas Undertakings

AT the Institution of Electrical Engineers on Thursday, May 6th, a joint conference of representatives of the electrical and gas industries was held to discuss means whereby the Government can be induced to give immediate consideration to the needs of the electrical and gas industries in the matter of coal supplies. As we have already reported in our columns, a deputation representing the two industries waited upon the President of the Board of Trade (March 11th, p. 103), but, so far as we are aware, no action has followed unless the Order in Council issued last week prohibiting the export of coal except to British Colonies and the countries of our Allies is a direct outcome of this conference.

The Conference on Thursday, which was presided over by Sir Corbett Woodall, Governor of the Gas Light & Coke Co., had the support of the Institutions of Electrical and Gas Engineers, and Sir John Snell, President of the Institution of Electrical Engineers, welcomed the Conference, which numbered some six hundred.

As a result of the discussion, the three following resolutions were passed :—

(1) That this Meeting congratulates the Government on having appointed a Committee to deal with the exportation of coal, and hopes that this may be effective in limiting exports, but views with the deepest concern the depleted stocks of coal and the difficulty, under present conditions, of renewing them for present and future requirements, and urges the Government to take further and immediate steps :—

- (a) To increase the output of coal from the pits.
- (b) To give greater facilities for the transport of coal by rail, and
- (c) To have regard, in requisitioning steam colliers, to the requirements of the Public Utility Undertakings which depend for their supplies on sea-borne coal.

(2) That the Government be asked to take such steps as may be necessary to reduce the price of coal to reasonable limits.

(3) That a representative deputation of the gas and electricity industries be now appointed to present our case to the Members of Parliament, and to take such further action as may be found advisable.

That a Conference with Members of Parliament be held in London on _____ to seek their aid in urging upon the Government immediate action to give effect to the above recommendations.

That each Authority represented pledges itself to take steps to secure the presence of their Member or Members of Parliament at the proposed Conference.

SIR CORBETT WOODALL, in opening the Conference, said that whilst at the beginning of the war the difficulties of obtaining coal supplies were largely a matter of freightage, to that had now been added the difficulty of price and an absolute shortage in coal supplies. Until recently there was sufficient coal available at the pits, and the increased cost of freightage was the chief complaint. It was, however, no longer a question of money, for the gas and electrical undertakings were faced with an actual famine in coal supply, which, however, was due to preventable causes. The question was a vital one to the nation, and extreme measures were necessary and inevitable. He felt that the Government should give a preference to the gas and electrical industries in transportation facilities both by sea and land, and on the question of price, the profits of the colliery owners and royalty owners should be limited in some way. Further difficulties had been introduced by the reduction of output, due to the enlistment of a large number of miners, whilst the increase of wages to those who remained had also had an effect. He had been told by an official in a responsible position in a Government department that the importance of the matter had been over-rated, that he was prepared to carry on his work by candlelight, and was not alarmed at the prospect of darkness throughout London; one aim was to bring the war to a successful end. On this latter point, needless to say, everybody was agreed, but it was surely well to consider with care the means by which it was to be accomplished. In making demands upon the Government to act, it was not a question of the gas and electrical industries seeking commercial profits for themselves. Both industries had statutory duties to perform, and it would be a catastrophe were it impossible to keep the industries of the country going owing to the impossibility of supplying sufficient gas and electricity.

SIR JOHN SNELL said the Council of the Institution of Electrical Engineers was desirous of doing all that was possible to assist in this most important matter provided that it did not embarrass the Government or the authorities in the proper conduct of the war, which must, of course, come first and foremost. At the same time, coal was necessary to the gas and

electrical industries for reasons of public health and public safety.

ALDERMAN KAY (Chairman of the Manchester Gas Committee), in proposing the first resolution, said that his undertaking was worse off for coal to-day than it was at the time of the coal strike. On March 31st the stock was 70,000 tons below the normal, and they were not obtaining supplies which more than equalled the consumption, and seeing that the gas and electrical undertakings were doing all they could to help the Government by supplying factories manufacturing munitions of war, it was evident how serious the question was.

MR. FRANK BAILEY (City of London Electric Lighting Co.), who seconded the resolution, expressed his satisfaction at meeting members of the gas industry in connection with this matter. They had met before on many occasions, sometimes in a sphere of hostility and sometimes upon matters of urgent necessity. They had laid side by side in the footways for many years, and when they had met they had generally exploded. He thought much credit was due to the electrical undertakings in detecting gas leakage, and that the gas undertakings had to thank the electrical industry for their proportion of unaccounted-for losses of gas being so small. In regard to coal supplies, his opinion was that facilities should be given to the electrical and gas industries even if no coal were available for the householder. Electricity and gas works should be regarded as the coal cellars of the country, and the potty little coal cellars of private houses should be prohibited. Unless active measures were soon taken, it would be perfectly hopeless to obtain a stock of coal sufficient to meet next winter's demands, and as an instance of the difficulties which were being encountered he said that the Admiralty was paying 35s. per ton f.o.b. for Cardiff for Welsh steam coal. Against this, what chance had the gas and electrical undertakings? If the real seriousness of the matter could be impressed upon the Government, he thought that some action would be taken. So far as he was concerned, he had no complaint whatever to make against the people who acted as intermediaries for getting the coal from the colliery to the point of consumption. The merchants had done all they possibly could.

MR. JOHN BOND (President of the Institution of Gas Engineers) said the gas industry had approached various Government departments on many occasions with regard to this matter, and he was pleased that the Board of Trade was now taking steps to restrict the exportation of coal.

MR. R. A. CHATTOCK (Chief Electrical Engineer, Birmingham), who represented the I.M.E.A. in the absence of Major Richardson, the President, said that in many cases stocks of coal had been reduced to something like 25 per cent. of what they were at the commencement of the war, although at the present time larger quantities were being purchased. The recent coal report dealt largely with the private consumer, but his demand only represented a tithe of the quantity consumed to supply the power and lighting required by factories employed on Government work, which it was essential to safeguard and maintain at all costs. The average increase in price at the present time was about 50 per cent. over the prices which ruled before the war commenced, and in the case of the municipal electrical undertakings this represented a total of between £500,000 and £600,000 per annum.

MR. REGINALD NEVILLE, M.P. (Bradford Gas Co.), said that unless something was done immediately, the public would have to be urged to restrict their consumption of gas and electricity. He hoped the Conference would put forward some concrete suggestion for getting over the difficulty, because unless something definite was placed before the Government department concerned nothing would come of the Conference. There was a great difficulty about using interned ships for transport, and there was no chance of getting more ships. There might be a possibility of the two industries combining to get hold of a colliery and working it themselves. He recognised that this was a risky business, but in time of war we must take risks. Another matter to which he called attention was that in times like these it was necessary that the Government should relax some of the onerous statutory conditions attached to the two industries, such as, for instance, pressure in the case of electricity and purification in the case of gas.

BAILIE IRWIN (Chairman, Glasgow Gas Committee) anticipated great benefit from the recent decision to restrict the export of coal, and was not disposed to recommend his consumers to economise. In Glasgow the total reserve on the occasion of the deputation to the Board of Trade a short time ago was 27,000 tons, against a normal of 100,000, but since then 77,000 tons had been bought, so that Glasgow was not so badly off.

SIR ALEXANDER KENNEDY (representing the Westminster Electric Supply Corporation) expressed his entire sympathy with the resolution, and agreed with Mr. Neville in the hope that something definite would be put before the authorities. He supported Mr. Bailey's remarks as to the behaviour of the coal merchants. He was certain that these were not making any extra profit; indeed, he had a suspicion that some of them were losing money in order to fulfil their contracts.

MR. HARRY JONES (Chairman of the Gas Companies Protection Association) said that charity began at home, and that

something should be done to prevent competition for our coal from abroad, which was bringing about fabulous prices.

SIR DANIEL GODDARD, M.P., said he gathered from conversations with men prominent in the coal industry that stopping the exportation of coal would largely bring about the object which the Conference desired.

BAILIE LINDSAY (Edinburgh) said that no less than 67 million tons of coal were exported from Great Britain in 1911. Another direction in which action should be taken was to suspend the operation of the Eight Hours Act, which was provided for under Clause 4 of the Coal Mines Regulation Act of 1906. Facts seem to show that the output of coal from the mines had been restricted by the action of the miners to the extent of 30 per cent.

A DELEGATE, apparently from a mining district, strongly denied that there was a general reduction in output by the miners. In his district the present output was larger than that for the corresponding period of last year.

THE CHAIRMAN said he believed there was no question whatever that the output of coal had been very materially reduced.

COUNCILLOR F. W. Dow suggested that an addition should be made to the resolution asking the Government to take over a mine which produced coal suitable for electricity and gas works.

THE CHAIRMAN said he could not accept this, and the first resolution as set out above was put and carried unanimously.

ALDERMAN PHILLIPS (Chairman of the Salford Gas Committee) moved the second resolution. He strongly felt that if prices did not soon fall to a suitable level, the Government should consider a scheme for assuming control over the output of all collieries during the continuance of the war.

ALDERMAN FRED HALL (Chairman, Workington Corporation Gas Committee) said that the cause of high prices was due to the colliery owners' associations. In his district the whole of the coal was sold through one association, and although he had been offered coal by his merchant at a price of 2s. 3d. per ton less than that fixed by the association, the latter had refused to allow the merchant to deliver at this lower price, notwithstanding the exceptional circumstances.

BAILIE SMITH (Chairman, Glasgow Electricity Committee) said he had heard only that day from a most trustworthy source that a large factory in Sweden for which we were supplying all the coal was manufacturing munitions for the Germans.

SIR JOSEPH BELLAMY (Plymouth) pointed out that the question of price could not be dealt with except by consideration of all the circumstances and the cost of production in every district before the war and now. It was a monstrous proposition that, if a gas company had a contract with a shipowner for twelve months, the Government should take a considerable portion of that firm's tonnage and possibly pay 50 per cent. more to the owner of the ship over the contract price, whilst the gas company had no compensation whatever, and had to pay probably from 200 to 300 per cent. more for other vessels.

MR. J. CHRISTIE (Chief Electrical Engineer, Brighton Corporation), speaking as a representative of an undertaking dependent entirely on sea-borne coal, said he paid about £15,000 a year for the partial services of a coaster which was not worth more than about £5,000, and evidently the profits of the owners were colossal. He suggested that the Chancellor of the Exchequer should limit the profits of such people to about 15 per cent. He also had no complaint whatever to make against the merchants who were supplying him.

A DELEGATE moved an amendment to the resolution by which the Government should be asked to fix the prices in accordance with the increased cost of production on the renewal of contracts.

THE CHAIRMAN said he did not think this was an amendment. The resolution in its original form was put to the meeting and carried by a very large majority.

THE CHAIRMAN then put the third resolution to the meeting. He said that if Mr. Neville had had an opportunity of reading this before he spoke he would not have thought there was no concrete proposal to be placed before the Government.

SIR JOHN SNELL seconded the resolution, which was carried unanimously.

It was decided to appoint the following deputation to Members of Parliament provided for in the third resolution:—

Sir Ryland Adkins, M.P. (Herne Bay Gas & Elec. Co.).

Mr. E. Allen (Liverpool Gas Co.).

Mr. F. Bailey (City of London Elec. Ltg. Co.).

Mr. J. Ferguson Bell (Derby Gas Co.).

Sir Joseph Bellamy (Plymouth & Stonehouse Gas Co.).

Mr. John Bond, President of Institution of Gas Engineers (Borough Gas Engineer, Southport).

Mr. W. G. Bradshaw (Commercial Gas Co., London).

Dr. C. Carpenter (South Metropolitan Gas Co.).

Mr. W. A. Chamen (South Wales Elec. Power Dist. Co.).

Mr. R. A. Chattock, representing the I.M.E.A. (City Elec. Engineer, Birmingham).

Mr. F. E. Cooper (Sec. Gas Cos.' Protection Ass.).

Mr. A. C. Cramb, President-Elect, I.M.E.A. (Borough Elec. Engineer, Croydon).

Mr. W. T. Dunn (Sec., Institution of Gas Engineers).

Mr. H. A. Earle (Yorkshire Elec. Power Co.).

Sir J. Fortescue Flannery, Bart., M.P. (South Sub'n Gas Co.).

Sir D. Ford Goddard, M.P. (Ipswich Gas Co.).

Mr. J. S. Highfield (Metropolitan Elec. Supply Co.).

Captain R. S. Hilton (Birmingham Corp. Gas Dept.).

Baillie Irwin (Glasgow Corp. Gas Committee).

Mr. J. R. H. Jacobs (Southampton Gas Co.).

Mr. H. E. Jones (Wandsworth, Wimbledon & Epsom Distr. Gas Co.).

Ald. Kay (Manchester Corp. Gas Committee).

Sir Alexander Kennedy, F.R.S.

Mr. A. Masterton (Edinburgh & Leith Corp. Gas Dept.).

Mr. C. H. Merz (Newcastle Elec. Supply Co.).

Mr. Reginald Neville, M.P. (Brentford Gas Co.).

Mr. G. W. Partridge (London Elec. Supply Corp.).

Mr. S. L. Pearce (City Elec. Eng'r, Manchester).

Ald. F. S. Phillips (Salford Corp. Gas Dept.).

Mr. W. E. Price (Hampton Court Gas Co.).

Mr. P. F. Rowell (Sec., Institution of Electrical Engineers).

Mr. A. H. Seabrook (Marylebone Elec. Supply).

Mr. James Smith (Belfast Corp. Gas Dept.).

C'r W. B. Smith (Electricity Committee, Glasgow Corp.).

Sir John Snell (President, I.E.E.).

Mr. C. P. Sparks (County of London Elec. Supply Co.).

Sir Albert Stanley (or other representative of the London Electric Railways Co.).

Mr. C. D. Taite (Lancashire Elec. Power Co.).

Mr. Hanbury Thomas (Sheffield United Gas Light Co.).

Mr. F. J. Walker (St. James's & Pall Mall Elec. Light Co.), representing the Conference of Chief Officials of London Electric Supply Companies.

Mr. D. Milne Watson (The Gas Light & Coke Co., London).

Sir Corbet Woodall (Gas Light & Coke Co., London).

THE ELECTRICAL EMERGENCY SERVICE

THERE are still many young men, keen and anxious to join the Army, who are being kept at home and obliged to continue their duties as switchboard attendants until other men who are unable to go away and fight can be found to fill their places. The Electrical Emergency Service is finding these other men. At the moment, we are devoting our attention particularly to London, where some hundreds of men will be wanted.

We have enrolled many members, several of whom are now already on duty at sub-stations in various parts of London, but very many more are wanted. The greatest number of offers have been for half-shifts (averaging four hours) for alternate nights. To release each man, four half-shifts on alternate nights are of course required, and for working half-shifts in the midnight hours, it is obvious that the volunteers must be men living near the stations or sub-stations. Some of the people on our register are still unplaced, owing to there being no call at present in the particular district in which they reside, but others are living in districts in which their services are required but are being kept waiting for more enrolments in order that the groups of four may be made up. We want *every* electrical engineer in London who will give four hours a day, or four hours on alternate nights, to become enrolled, and we want them most urgently in the following districts: Hammersmith, Wandsworth, Tooting, Streatham, Clapham, Stockwell, Battersea, Camberwell, Holborn, Camden Town, Islington, Mildmay Park, Clapton, Hackney, Limehouse, Barking, Poplar, Woolwich, Lewisham and Forest Hill. Although this list is a long one, it by no means represents the whole of the requirements; but in these districts the demand for assistance is being acutely felt.

Moreover, it is the *good men* we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees, but who are willing now to defer their rest a little longer in view of the national emergency.

Applications for enrolment, on the form on p. ix, should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

THE B.E.A.M.A. STANDARDISATION RULES

A NEW edition was recently issued of the Standardisation Rules for Electrical Machinery (excluding railway and tramway motors) which have been provisionally adopted by the British Electrical and Allied Manufacturers' Association. The first six sections, relating respectively to standard pressures and frequencies, high-pressure tests and insulation resistance, types of machines, rating, overloads, and heating arc, contain practically no alterations since the first edition published in 1913, which we reviewed in ELECTRICAL ENGINEERING, Vol. IX., p. 285, May 22nd, 1913. A supplement has, however, been added, comprising seven sections dealing with tolerances, parallel running, commutation, short-circuit tests, terminal markings of transformers and machines, and switchgear symbols.

A tolerance is defined as the amount of permissible difference between the observed results and the guaranteed results. The figures recommended are 2° C. for observations of temperature rise, and the following for efficiencies, &c.:—Steam consumption, 2½ per cent. Transformers, 0·25 per cent. if over 98 per cent., and 0·4 per cent. if under. Generators, motors, and converters (by summation of losses):—If full load efficiency is 95 per cent. or over, tolerance ½ per cent.; from 93 to 95, ¾ per cent.; 90 to 93, 1 per cent.; 85 to 90, 1½ per cent.; 75 to 85, 2 per cent.; 65 to 75, 3 per cent.; below 65, 4 per cent. If the determination is by the input-output method, these tolerances may be increased by ½ per cent. over 88 per cent., and 1 per cent. below. Power factors, above 0·9, 2 per cent.; from 85 to 90, 3 per cent.; 75 to 85, 4 per cent.; 65 to 75, 6 per cent.; below 65, 8 per cent. Where efficiency guarantees are required at practical loads, it is recommended that they be given in the form of an average load guarantee based on the sum of four times the full load efficiency, three times the ¼ load efficiency, and twice the ½ load efficiency, divided by nine. The same tolerances as above apply to this figure. Speed of motors:—Shunt, 5 per cent. of full load temperature; series, 7½ per cent. Slip of induction motors, 50 per cent. tolerance. Inherent pressure regulation, 2/5 of value specified.

With regard to conditions for satisfactory parallel running of alternators and other synchronous machinery, with reference to the permissible amount of angular displacement from uniform running due to periodic irregularity in the turning movement of the prime mover, it is pointed out that a periodic angular displacement of 2½ electrical degrees will usually cause 15 to 20 per cent. exchange current, and this is the limit recommended. This limit corresponds to a cyclic irregularity (i.e., max. minus min. divided by mean speed) equals number of engine impulses per revolution divided by six times the number of poles. In any case, this should not be more than 1/16. Hunting due to resonance between engine impulses and the natural electro-mechanical frequency of the system can be met by suitable flywheels or dampers on the generator. The total foot tons of energy stored in the flywheel for this purpose should be:—

$$1\frac{3}{4} \times \text{poles} \times (\text{strokes per engine cycle})^2 \times \text{k.v.a.}$$

r.p.m.

The electrical damping arrangement can only be relied on when the coefficient of fluctuation of energy does not exceed 10 per cent.

The section regarding commutation reads as follows:—D.C. machines must operate throughout the range from no load to the highest specified overload with fixed brush setting. The operation must be practically sparkless from no load to full load, and without injurious sparking up to the maximum specified overload.

The section on short-circuit tests on alternators points out that no guarantees regarding short-circuit currents should be undertaken in connection with machines required to have close inherent regulation. In view of the regulators available, close regulation is regarded as unnecessary.

In further sections of the rules a system of arranging and marking transformer terminals and machines is described, a matter where uniformity is most desirable; and the final section gives rules for drawing switchboard diagrams with standard colouring of phases, symbols and lettering for instruments, and diagrammatic symbols of the usual character for switches, connections, gear, and parts of machines.

An Indicator for Detecting Shorts on Tramway Feeders.—In Mr. Braid's article on this subject on page 194 of last week's ELECTRICAL ENGINEERING, in the inscription under Fig. 1, the bottom figures on the dial of the indicator were given as referring to the value of I . This should have been the value of x , the resistance of the short.

MUNICIPAL WIRING

TWO interesting decisions have been given by Parliamentary Committees since our last issue in connection with municipal wiring.

The first one concerns Plymouth. The Plymouth and Devonport Corporations were amalgamated into a larger Plymouth last year, and this session the Plymouth Corporation came to Parliament with a Bill to consolidate the various Acts of Parliament relating to the two old boroughs in order to have one code relating to the new and enlarged borough. The old Devonport Corporation had full municipal wiring powers, obtained in the early days, no provision being made for the work being done through a contractor. On the other hand, old Plymouth had no wiring powers of any description. In the Consolidation Bill this session a proposal was made to extend the Devonport wiring powers to the whole of the new borough, but this was opposed by the Plymouth Mercantile Association, which numbers among its membership the electrical contractors in the town. This Association asked for what is known as a "Model Clause," viz., that under which, although the Corporation may borrow money for wiring, all work must be done through a contractor. The case for the Corporation was that in Devonport the full wiring powers have been extremely useful in extending the supply, and although it was shown by the opposition that the rate of progress of the old Devonport electrical undertaking had not been so rapid, where the Corporation did wiring direct, as that in Plymouth, where the contractors did the work, yet Mr. J. W. Sparks, the Engineer-in-Charge of the Devonport section of the enlarged Plymouth undertaking, stated that this was entirely due to the character of the population in Devonport, which was a shifting one, composed as it is largely of workmen employed in the dockyards. He gave figures showing that, compared with the period when the Corporation did not have these powers, the rate of progress had been very rapid. Several electrical contractors were called on behalf of the opposition, and Mr. Leonard Tate, Secretary of the Electrical Contractors' Association, was also in attendance instructing counsel for the Plymouth Mercantile Association. In the end, however, the House of Lords Committee which was dealing with the matter decided to grant the old Devonport powers to the new and extended borough of Plymouth.

The second case was that of the Lincoln Corporation, which was considered by the Local Legislation Committee of the House of Commons. In the Lincoln Corporation Bill, as originally drafted, some interesting clauses were included dealing with the question of wiring, as detailed on p. 8 of our issue for January 7th. Briefly, these gave full wiring and hiring powers with an option to enter into agreements with contractors, and a special clause was inserted for securing co-operation between the Corporation and the electrical contractors. That, however, met with considerable opposition by the electrical contractors, and the Bill came before the Committee with the original clauses struck out. These were substituted by a new clause agreed between the Corporation and the Electrical Contractors' Association, providing that the Corporation could sell fittings to a consumer after they had been on hire for three years. It also provided that if, as the result of a visit to the Corporation showrooms, a sale of fittings was effected through a contractor, 25 per cent. of the discount received by the contractor was to be paid to the Corporation as profit. All wiring work, however, was to be carried out through a contractor. The Local Legislation Committee is very loth to depart from the clauses in the "Model Bill," and the promoters admitted that this clause differed very widely from the "Model Clause" in form, but said that the essentials were preserved. It was pointed out on their behalf that local authorities were very hampered by the "Model Clause," and a member of the Committee suggested that perhaps this was intended to be the case. Eventually the Committee decided that although the proposed clause had been agreed with the Electrical Contractors' Association, the "Model Clause" must go into the Bill.

Institution of Civil Engineers Premiums.—Telford Premiums have been awarded by the Council of the Institution of Civil Engineers to Dr. H. F. Parshall for his paper on "Economics of Electrical Railway Distribution," and to Mr. H. E. Yerbury for his paper on "Electrolysis by Return Currents."

The Institute of Marine Engineers.—The headquarters of this Institute have been removed from Romford Road to The Minories, Tower Hill, E., to which address all communications for the Secretary should be sent.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,442.

A 12-pole single-phase alternator, the rotor of which has open slots and is wound like an ordinary D.C. wave armature, has an extremely bad regulation on low power factors ($\cos \phi = 0.3$ to 0.5).

Ratio of Pole arc to Pole pitch = 0.63. Air gap = 0.05".

Can the regulation be improved without re-winding the rotor? If not, should slots in rotor between the poles be left empty, so as to diminish the rotor demagnetising effect? Would tunnel slots in the rotor improve the regulation? With 121 slots in rotor, should tappings be taken from slots 1 and 11 or 1 and 61?—"YELE."

(Replies must be received not later than first post, May 20th.)

ANSWERS TO No. 1,440.

A mixed load (90 per cent. induction motors) of 300 kw. is required at 450 volts, three phase, 50 cycles, at a distance of 200 yards from the supply. Calculate size of three-core paper cable, and prove that it is the economical size when supply is 5d. per unit.—"CABLE."

The first award (10s.) is made to "L. R.," who writes as follows:—

The first point to determine is the current per phase of the system. This equals

$$\frac{K \times 1,000}{E \times F \times 1.73}$$

where K = kilowatts = 300
 E = volts = 450, and
 F = power factor = say 0.7.

Thus, current per phase equals

$$\frac{300 \times 1,000}{450 \times 0.7 \times 1.73} = 550 \text{ amperes.}$$

For a paper lead cable each core would require to have an effective area of just over $\frac{1}{2}$ sq. in. at the thousand amperes per sq. in. standard, or about 0.9 of a sq. in. at the I.E.E. standard, the list sizes in each case being respectively 61/0'108 and 91/0'112.

Now for the most economical size conductor, Kelvin's law is ordinarily employed as a test. This law says if the capital outlay on a conductor varies in strict proportion to the weight of the metal, then the most economical size is that for which annual cost of interest and depreciation equals annual cost of wasted energy. In this case the capital outlay does not directly vary with the weight of metal. First of all because of the kind of conductor. Also the particular ratio cannot be definitely ascertained, as no data are available showing how the cable is to be laid, and so on. The principle involved can, however, be explained by assuming the capital outlay to be in proportion as indicated.

Now take the cost of a three-core cable, with each core made as above at, say, £1,760 per mile, i.e., £1 per yard and £200 for the length given. Assume interest and depreciation at 10 per cent., then one side of the equation comes to £20.

$$\text{Now drop in volts} = \frac{C \times 2D}{A \times 38.5 \times 1,000}$$

where D is the length of each core, and A the area.

The drop, therefore, equals

$$\frac{550 \times 400}{0.5 \times 38.5 \times 1,000} = 2.94$$

(in the case of the cable of $\frac{1}{2}$ sq. in. section).

$$\text{Power lost} = C \times E \times F \times 1.73$$

$$= 550 \times 2.94 \times 0.7 \times 1.73$$

$$= 1,940 \text{ watts.}$$

Now, assuming the load to be on for 8 hours per day, and 300 days per year = 2,400 hours per year at ½d. per unit, the loss is

$$\frac{1.94 \times 2,400 \times 0.5 \times 1}{240} = 29.7$$

Working similarly on the other size cable, it comes to £5.4.

It will, therefore, be seen that this figure is nothing like so high as the depreciation figure, which means that the theoretical most economical section cannot be used in this case, but the smallest section must be employed that will carry the current at the highest possible rating. The case really is complicated by other factors not dealt with above.

No second award is made.

ANSWER TO CORRESPONDENT

"A. B."—(1) We cannot identify the gauge from your description. Possibly it is an ordinary vacuum gauge reading both in inches and lbs. per sq. in. (2) To obtain the power in kw. multiply the kilovolt-amperes by the power factor. (3) We do not know of any dictionary of mechanical engineering terms. Hobart's Dictionary of Electrical Engineering, 2 vols. (35s. net), or Sloane's Electrical Dictionary (7s. 6d. net) contain definitions of electrical terms. We particularly recommend the former. Our Book Department can supply copies of either.

Students' Section of the Institution of Electrical Engineers.—The Annual Report of the Students' Section of the Institution of Electrical Engineers records the holding of six meetings in London, nine in Manchester, and four in Newcastle. The usual summer tour, annual dinner, and other social functions were suspended, and only one visit to works has been held. The Annual General Meeting was held on May 5th, when Sir John Snell delivered an address.

An Electromagnetic Balance.—To meet certain requirements of chemical research, it is necessary to be able to weigh substances with considerable accuracy in a vacuum and a special balance for this purpose worked electromagnetically was described in a Paper by Dr. J. S. Anderson, read on Tuesday before the Faraday Society. The apparatus is essentially a current weighing balance reversed, as instead of weights being employed, one scalepan is replaced by a coil moving in the field of two fixed coils all connected in series and carrying an adjustable current. The details of the apparatus are worked out with great ingenuity, and a solenoid operated lever is used for releasing and fixing the beam of the balance.

Scottish Local Section of the Institution of Electrical Engineers.—The Annual Report of the Section records the holding of six meetings during the past session. The membership, including all classes, is now 385. The following officers and committee have been elected for next session:—Chairman: Mr. D. A. Starr; Vice-Chairman: Mr. J. K. Stothert; Past Chairmen (ex-officio Members of Committee): Messrs. W. M'Whirter, S. Mavor, and J. Lawson; Chairman of Students' Section: Mr. A. Page; Ordinary Members of Committee: Messrs. J. S. Nicholson, E. T. Goslin, G. Stevenson, J. E. Sayers, A. S. Hampton, Prof. J. D. Cormack, Messrs. F. H. Whysall and W. W. Luckie, Prof. M. Maclean, Messrs. A. Lindsay and A. Wilson; Hon. Secretary and Treasurer: Mr. J. Taylor; Assistant Honorary Secretary: Mr. W. F. Mitchell.

A Large Water-power Scheme for Ireland.—Some particulars of an ambitious water-power scheme in Ireland are contained in the *Irish Industrial Journal*. The scheme in question involves the combination of two power houses utilising the waters of the Shannon and Erne, and capital expenditure amounting to one and a half million pounds. The drainage area of the Shannon is 6,000 square miles, and the average discharge is given as 1,320,000 cu. ft. per min. at an available head of 40 ft., equivalent to some 60,000 h.p. all the year round. It is proposed to utilise lakes Derg, Rea, and Allen as storage reservoirs. The catchment area of the Erne is almost half that of the Shannon, but a head of 60 ft. is said to be available. Comparatively little in the way of dams would be required, although considerable dredging would be required below the fall, and a 2½ conduit would be required. It is proposed to establish transmission lines to Dublin, Cork, Waterford, Kilkenny, and other centres. There appears to be some difference of opinion as to the financial prospects of the scheme in its present form.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 6th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

3,702/14. Locking Lamp-holder. H. MARKS and S. HELSEL. This is a switch-holder for Edison screw-cap lamps in which the receptacle into which the lamp screws is mounted so that although prevented by a ratchet device from rotating when the lamp is screwed in, it is free to rotate with the lamp when an attempt is made to unscrew it. A ratchet spring is provided to ensure that the lamp brings the receptacle with it in this way. A set screw is fitted by which the receptacle can be locked when desired, and the lamp unscrewed from it, notwithstanding the ratchet spring. It is possible, however, to remove a lamp cap of a burnt-out lamp by breaking away the bulb, when an outer sleeve can be slid off and the receptacle held from revolving. (Five figures.)

9,305/14. Plugs and Sockets. J. W. ANNAND. Several forms of plug and socket connections are described in which good contact is obtained over a large area by making a portion of the interior surface of the socket or the exterior surface of the plug in a separate piece held up by springs. (Thirteen figures.)

9,578/14. A.C. Motors. B.T.-H. Co. and N. SHUTTLEWORTH. A.C. commutator machines having commutating poles, each of which is provided with one or more auxiliary leakage paths forming a return path for the commutating pole flux and unembraced by the main exciting coils. (Five figures.)

15,155/14. Electric Traction. SOC. ANON. DITE S.T.A.R. (Système de Traction Auto-Regulateur). A D.C. traction system in which the motors are started at a maximum predetermined torque, which diminishes as the motor speeds up owing to the action of a constant speed booster machine in series with the motors, which is differentially excited by components proportional, respectively, to the motor voltage and current respectively. (Two figures.)

15,700/14. High-speed Railway. A. OATES. A system of high-speed traction in which hermetically sealed passenger cars travel in tunnels from which the air has been exhausted, entering and leaving through a water seal. (One figure.)

18,127/14. Telephone for Aircraft. L. G. HAMMER. A special form of telephone for communication between the pilot and observer in aeroplanes, with the mouthpiece attached to the headgear and a microphone damped against the effect of external sounds by tufts of silk floss among the carbon granules. (Five figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: ZANOTTA [Cinematograph arc lamps] 676/15.
Distributing Systems, Cables and Wires, Insulating Materials, &c.: SIMPLEX CONDUITS, LTD., and WATERHOUSE [Conduit joints] 9,123/14; BEAVER and CLAREMONT [Cables] 9,554/14; STELL [Cables] 10,440/14.

THE BRITISH INDUSTRIES FAIR

A N interesting and representative exhibition of British manufactures, chiefly in fields where German competition has hitherto been heavily felt, has been got together by the efforts of the Commercial Intelligence Branch of the Board of Trade for the benefit of trade buyers in home and overseas markets. The trades represented relate to toys, earthenware and china, glass, fancy goods, cutlery, plate, clocks, jewellery, &c. Stationery and printing and electric goods are only present in so far as they are incidental to these trades.

In the clock section there is a good display by the Synchro-nome Co. (32 Clerkenwell Road, E.C.) of a number of different forms of dials driven by their well-known impulse system from a master-clock. An exhibit of electric clocks is also made by the Silent Electric Clock Co., Ltd. (192 Goswell Road, E.C.).

DYNAMOS, MOTORS AND TRANSFORMERS: MOND (Maschinenfabrik Oerlikon) [Protection of motors against fire-damp] 9,542/14; PYRAE [Commutators] 10,050/14; MIDDLEY and VANDERVELL [Variable-speed dynamos] 24,604/14.

Switchgear, Fuses and Fittings: HIRST and BROOK [Switch-gear] 17,899/13; CARTER, MAURICE & RAILING [Lamp supports] 17,052/14.

Telephony and Telegraphy: MARKS (Electrical Experiment Co.) [Telephone transmitters] 9,637/14; McGAURAN [Telephone call recorders] 12,232/14.

TRACTION: THOMAS TRANSMISSION, LTD., and THOMAS [Driving of vehicles] 9,454/14; STUART [Electric railway systems] 9,582/14.

MISCELLANEOUS: HAMMOND [Distant control of moving bodies] 6,588/14; VÉRON [Pocket lamps] 9,768/14; REID [Electric clocks] 9,832/14; PARSONS and BENNETT [Searchlight reflectors] 10,172/14; GOLDSTONE [Portable battery lamps] 14,060/14; PORDÈS [Enclosing portable batteries] 15,363/14; SCHMIDT [Cooling towers] 21,205/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: ZIMMERMANN [Commutators] 5,848/15.
IGNITION: R. BOSCH [Starting arrangements] 5,865/15.

INSTRUMENTS, &c.: BRITISH WESTINGHOUSE ELECT. & MFG. CO. [Measuring instruments] 5,554/15.

MISCELLANEOUS: SCHIESSLER [Relays] 20,238/14; SIEMENS & HALSKE A.G. [Alarm system] 5,623/15.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

10,120/01. TELEGRAPHY. A. MUIRHEAD. Improvements in automatic tape transmitters.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS AND TRANSFORMERS: H. A. MAVOR and MAVOR & COULSON [Application of induction motors with rotatable "stators" to winding plant] 1,450/08; PHOENIX DYNAMO & MOTOR CO. and R. FOHL [Equalising connections on armatures] 1,546/08; A. G. BROWN, BOVERI & CO. [A.C. commutator motors] 20,827/09.

IGNITION: H. H. LAKE (Fabrik Elektrischer Zunder G.m.b.H.) [Electrically ignited flashlight] 1,544/02.

TELEPHONY AND TELEGRAPHY: J. E. KINGSBURY (Western Electric Co., U.S.A.) [Transposition of conductors in telephone cables] 1,389/06; A. KORN [Writing telegraphs] 1,548/07; E. RAYMOND-BARKER and AMALGAMATED RADIOTELEGRAPH CO. [Double tone wireless signalling] 1,759/07; A. ROSENBERG [Microphones for the deaf] 1,420/09.

TRACTION: G. HUGHES [Railway signal recorder] 1,589/06; E. UNVERRICHT [Railway signalling] 24,244/09.

MISCELLANEOUS: A.G. MAGNETA (Elektrische Uhren ohne Batterie und ohne Contacte) [Magneto-electric current impulse producers] 24,310/07; NATIONAL CASH REGISTER CO. (N.C.R. CO., U.S.A.) [Cash registers with electric indicating bells] 1,598/04; M. LATOUR [Electromagnets] 952/05; H. W. RAVENSHAW [Magnetic clutches] 1,781/07.

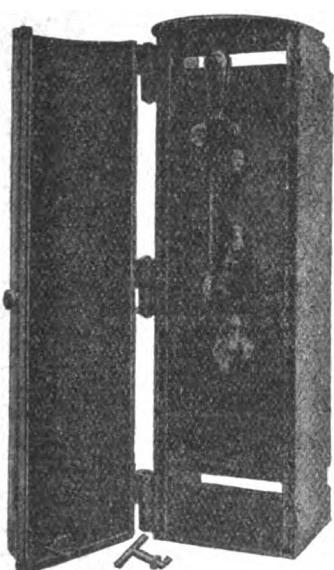
The only other branch of the electrical industry represented to any great extent is the manufacture of pocket-lamps, torches, &c., and refill batteries, a trade to no small degree in the hands of Germany before the war. The best stand of this nature is that of the New British Ever-Ready Co. (Hercules Place, Holloway), who have an extensive display embracing every variety of portable lamp. Pocket-lamps and refills of British manufacture are also shown by the Efandem Co., Ltd. (Wolverhampton), and the Surrey Electrical Co., Ltd. (9 Surrey Lane, Battersea Bridge Road, S.W.), who show various other small electrical toys and novelties. Another firm having a good stand of apparatus of this nature, covering an even more extended range, is Ward & Goldstone (Springfield Lane, Salford, Manchester). Small electrical appliances, including those of the nature of toys, are shown on several stands, notably that of the Economic Electric Co. (Twickenham), but no very striking novelty is represented. Electrical models figure to some extent in the effective show of engineering and naval models of

Bassett-Lowke, Ltd. (Northampton), and a very fine electrically worked model railway has been arranged by British Metal and Toy Manufacturers, Ltd. (Audry House, Ely Place, E.C.).

In the china and glass section, which contains a large and remarkably fine collection of the results of British industry, a few firms, such as F. and C. Osler, Ltd. (Broad Street, Birmingham), show cut-glass electric light fittings, &c., and shades, &c., are exhibited by H. G. Richardson & Sons (Stourbridge), H. Wolff & Co. (13 Bunhill Row, E.C.), and other firms. There are a few electrical instruments among the apparatus shown by J. Pitkin & Co. (56 Red Lion Street, Clerkenwell). Attention may also be called to the exhibits of special materials forming substitutes for ivory, which have many uses in the electrical industry, and in particular the hard, non-inflammable insulating material "Erinoid," of which samples are shown by Syrolit, Ltd. (Stroud, Gloucester).

It is not strictly in our province to speak of the other industries represented at the Fair, but it may be remarked that the Printing and Stationery section contains a profusion of examples of colour-printing and other illustration work showing that this country is by no means behind the Continent in that class of work. A large number of the leading firms contribute to this fine show, including our friends Messrs. Richard Clay & Sons, Ltd. (London and Bungay).

A TRAMWAY SECTIONING SWITCH



300-AMPERE TRAMWAY SECTION SWITCH.

with nuts and washers. These pass through the horizontal apertures seen at the top and bottom at the back of the case; and the two nuts tighten down on the metal-work and thereby secure the case to the pole. The Company has in hand larger sizes, and will be pleased to meet the requirements of any tramway authority.

An Iron Cross.—Dr. G. Klingenberg, director of the A.E.G., who will be remembered as having given a lecture not long ago before the Institution of Electrical Engineers, has been awarded an Iron Cross.

Imperial College of Science and Technology.—The London County Council announce that they are prepared to award for the session 1915-16 a limited number of free places at this college. Full particulars and application forms may be obtained from the Education Offices, L.C.C. Education Offices, Victoria Embankment, W.C., and applications must be sent in not later than Saturday, May 22nd.

EVERY INSTALLATION ENGINEER

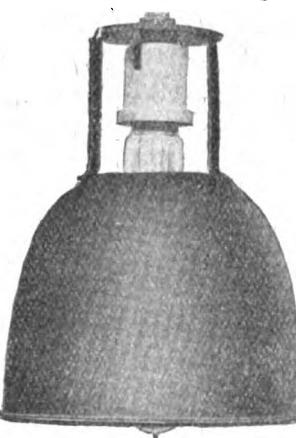
Should join his Trade Protection Organisation,
THE

ELECTRICAL CONTRACTORS' ASSOCIATION (Incorporated).

Inquiries cordially invited by the Secretary,
L. G. TATE,
20, Bucklersbury, LONDON, E.C.

A REFLECTOR FITTING FOR HALF-WATT LAMPS

A NEW form of reflector fitting for use with half-watt lamps, which has been brought out by the Benjamin Electric, Ltd. (1a Rosebery Avenue, E.C.), is illustrated here. The reflector is $\frac{3}{4}$ in. diameter, and the total height of the fitting is 12 in. Designed primarily to give maximum light efficiency for a minimum consumption in watts, the contour of the reflector is such that the bare filament is hidden from the direct line of vision, while the distribution of light is calculated to produce the most efficient illumination on the working plane. The construction is simple and the design novel, the skeleton neck ensuring ample ventilation for the lamp, while the Benjamin Goliath holder, with which the fittings are equipped, facilitates wiring and eliminates overheating of the connecting terminals. The reflectors are of vitreous enamelled steel, finished white inside and green outside, and are designed for direct lighting, a wide distributed illumination being obtained with their use.



REFLECTOR FITTING FOR HALF-WATT LAMPS.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Victorian Railway Commissioners require a 9-kw. motor-generator and accessories for battery charging, and four electric motors and accessories. June 30th. Offices of Commissioners, Spencer Street, Melbourne.—The New South Wales Government Railways & Tramways Dept. requires a 250-k.v.a. direct-coupled turbo-generator. Electrical Engineer, 61 Hunter Street, Sydney, N.S.W. Further particulars in both cases at 73 Basinghall Street, E.C.

Blackrock.—The Council has received sanction to proceed with its electric lighting scheme.

Derby.—An expenditure of £1,000 is contemplated upon mains and motors for supplies for war purposes.

Dublin.—Automatic stoker for Babcock boiler at Pigeon House Fort. Borough Electrical Engineer. May 25th. (See advertisement on another page.)

Kingston-on-Thames.—With regard to the proposed loan of £11,000 to meet estimated requirements on mains, &c., during the next four years, the L.G.B. has intimated to the Corporation that it is only prepared to proceed with the application with a view to the work being put in hand after the war.

Madrid.—Plant for a hydro-power station at the Principe Alfonso drainage works, Palencia, is required. Further particulars at 73 Basinghall Street, E.C.

Southampton.—New cable at an estimated cost of £500 is to be laid.

Waterford.—A L.G.B. inquiry was held last week concerning a loan of £30,000 for the Corporation's electric lighting scheme. Mr. E. M. Lacey, the consulting engineer, gave evidence to the effect that within three years the scheme, in his opinion, would be self-supporting.

Wigan.—Three-core paper- and lead-covered armoured cable; transformer and switchgear. Borough Electrical Engineer. May 29th. (See advertisement on another page.)

Willesden.—The L.G.B. has sanctioned the carrying out of extensions required for war purposes.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Birkenhead.—Cinematograph theatre. Architect, A. E. Shannon, 35 Dale Street, Liverpool.

Chadderton.—Hospital (£11,500).

Manchester.—Nurses' Home at the Withington Institution. Architect, F. H. Overmann, 49 King Street.

Rochdale.—Sanatorium (£14,000).

Miscellaneous

Grangemouth.—Twelve months' supply of electric lamps. Burgh Engineer.

Spain.—Submarine cable between Cadiz and Larache. Further particulars at 73 Basinghall Street, E.C.

**TENDERS RECEIVED AND ACCEPTED
AND ORDERS PLACED**

Bradford.—The tender of the Brush Electrical Engineering Co. for a 600-k.v.a. three-phase transformer at £222 is recommended for acceptance.

Leith.—A contract has been placed by the Tramways Dept. with Siemens Bros. Dynamo Works for a twelve months' supply of carbon filament lamps.

Rochdale.—Messrs. Siemens Bros. Dynamo Works have received an order for a twelve months' supply of Wotan, Traction, and Standard lamps from the Tramways Dept.

Contracts have been placed with Venner & Co. for twelve months' supplies of Chamberlain & Hookham meters for Colwyn Bay and Edinburgh. A repeat order from Cardiff for 99 Venner time-switches has also been received.

**MISCELLANEOUS BUSINESS NOTES AND
TRADE ANNOUNCEMENTS**

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £88 to £89 (last week, £85 10s. to £86 10s.).

Advance in Prices.—The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., announce an advance of 10 per cent. in their prices of gutta percha, india rubber, silk, and cotton covered wires (List No. 27). List prices of tools, jointing materials, &c., are withdrawn, and quotations can be had on application.

The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), announce a rise in prices of 25 per cent. in distribution boards, branch switches, wall plugs, adaptors, ceiling roses, cut-outs, and flashers, and 50 per cent. on lampholders.

Agency.—A firm of engineers in Milan wishes to represent British manufacturers of electric motors. Further particulars at 73 Basinghall Street, E.C.

Change of Address.—The general offices of the Smithfield Markets Electric Supply Co., Ltd., have been removed to 47 Terminus Chambers, 6 Holborn Viaduct, E.C. (Tel.: Holborn 682.)

APPOINTMENTS AND PERSONAL NOTES

Mr. J. Shepherd, who was Assistant Electrical Engineer of the L.C.C. Tramways Department under Mr. J. H. Rider, and became "Electrical Assistant in the Tramways Department" under Mr. A. L. C. Fell, the Chief Officer, on Mr. Rider's leaving, has resigned. He has acquired an interest in a well-known firm of consulting engineers, and takes up his new position on July 1st. The Council, we understand, however, are retaining his services in an advisory capacity until the end of September.

An electrical engineer is required for a mine plant in Borneo, and a shift engineer at Battersea.

LOCAL NOTES

Birmingham: The Nethells Power Station.—Such satisfactory progress has been made with the new power station at Nethells that it is anticipated supply will be given by the

end of August. There is every probability that Mr. R. A. Chattock and his staff will have constituted a record for power-house construction work. The main part of the station will consist of 10,000 kw., the plant comprising two 5,000-kw. turbo-alternators with condensers, five cooling towers, and six boilers. This first section will, as already pointed out in our columns, constitute the temporary station, and the plant is so constructed that it can be removed to form part of the permanent station later.

Coventry: Record Output.—The fact that the total number of units sold by the electricity undertaking during the year to March 31st, 1915, was 20 $\frac{1}{4}$ millions as against 16 $\frac{1}{2}$ millions in the preceding year testifies to the exceptional activity in Coventry due to the war. The Committee's report for the year brought forward high praise for the management of the undertaking in the hands of Mr. G. Tough, whose increase of salary, mentioned on p. 202 of our last issue, has been willingly granted. More than one of the large works in Coventry have dispensed with private plants and are now taking the whole of their supply from the Corporation. The net profit for the year was £22,829, and the total balance available including the amount brought forward is £28,148. Of this the Committee recommends that £6,000 be paid to the rates, £10,186 to special reserve, and £6,961 to the ordinary reserve fund of the undertaking. A sum of £2,000 is to be used for house services.

Derby: Unauthorised Borrowings.—At the last meeting of the Corporation, attention was drawn to the fact that a sum of £4,000 had been spent by the electricity undertaking without the sanction of the L.G.B. It was explained, however, that this was in accordance with the usual practice and one suggested by the L.G.B., which in ordinary circumstances preferred to hold one inquiry per annum for all borrowings required for mains extensions, and pending these inquiries the Board raised no objection to extensions in the ordinary way of business being carried out without official sanction.

Leigh: War Contracts Delayed.—The Anchor Cable Co., who are employed on Government contracts, have reported to the Director of Navy Contracts that work in hand for the Admiralty has been seriously delayed owing to difficulty experienced in getting sufficient electricity for the works. The Corporation has explained the present position of affairs to the Director of Navy Contracts, and the Council is taking steps with a view to getting the L.G.B. to expedite sanction of an application before them in which the Corporation seeks power to borrow for extensions to their electricity plant.

London: L.C.C.: Restricting Capital Expenditure.—The Treasury has suggested to the Finance Committee that the proposed expenditure of £88,000 on two additional turbo-generators at Greenwich should be deferred for, say, six or twelve months. The Treasury recognises that this is an expenditure of urgent importance which cannot be deferred indefinitely, and indicate that they will not refuse sanction for the borrowing of the money when the L.C.C. determine that it is absolutely impossible to further postpone the expenditure.

Luton: Tradesmen and Power Units.—In order to dissipate a feeling which apparently exists in Luton, as it has existed in so many other places at different times, that power supplied at low rates constitutes a serious loss to the undertaking, the Borough Electrical Engineer last week invited members of the Tradesmen's Association to visit the electricity works, and subsequently explained to them the economics of the subject of power supply.

Southport: Increased Charges.—A 10 per cent. increase in the charges for electricity is recommended.

Wrexham: Municipal Wiring.—The solicitors to the Electrical Contractors' Association have written to the Corporation asking for an undertaking that the wiring of consumers' premises and the sale of electrical fittings be discontinued. If such an undertaking is not given, it is stated that an injunction will be applied for. The Electricity Committee has replied to the effect that the Corporation does not carry out actual wiring, nor does it sell lamps or fittings.



ELECTRICAL ENGINEERING

With which is incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, MAY 20, 1915.

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Small prepaid Advertisements for SITUATIONS VACANT AND WANTED, ARTICLES FOR SALE AND WANTED, &c., are inserted at the rate of One Penny per word, minimum One Shilling, three insertions for the price of two.

OFFICIAL NOTICES AND TECHNICAL COLLEGE ANNOUNCEMENTS are inserted at the rate of Ninepence per line (column width).

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Teleg. "Circling, Fleet, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

ALTHOUGH between 200 and 300 applications for enrolment in the Electrical Emergency Service have been received, many more are wanted, and for some districts of London they are wanted urgently (p. 212).

THE result of the ballot for the new Council of the Institution of Electrical Engineers is announced on page 213.

THE Annual Report of the Council of the Institution of Electrical Engineers records a slight diminution in membership due to the war, and calls attention to the activity of the Institution in recruiting and similar matters. Over 900 members are serving with the colours (p. 213).

AN "Electrical Wholesalers' Federation" has been formed, and some prominent firms are already known to have joined it (p. 213).

MR. G. MAURICE of the General Electric Co., and a son of Mr. Bernard Drake were lost in the *Lusitania* (p. 213).

SOME descriptive details are given of the new gas engine-driven station of the Tottenham District Light, Heat & Power Co. for the supply of the Wood Green district (p. 214).

A MOVEMENT in favour of the extension of concentric wiring in the United States and Canada has been delayed, to give American manufacturers further opportunity to consider the matter (p. 215).

THE electrical equipment of a saw mill is described (p. 215).

SEVERAL technical books are reviewed (p. 216).

A CRANK shaft broke at the Barking electricity works last week, making it necessary to shut down part of the H.T. supply (p. 216).

THE comparative merits of series and shunt wound motors for fan driving are discussed in our Questions and Answers columns (p. 217).

AMONG the subjects of specifications published by the Patent Office last Thursday were ironclad switches, conduit joints, cables, telephones, electric traction, and commutators.—A patent of A. Christmas for motor-car ignition and lighting apparatus is opposed.—One of the Edison battery patents and a B.T.-H. oil-switch patent expire during the current week after a full life of 14 years (p. 218).

OWING to the shortage of copper, German firms are making lamp-holders, sockets, and other accessories of brass-covered iron instead of brass (p. 218).

SOME new portable tools and shop window reflectors are described in our trade section (p. 219).

EXTENSIONS are to be carried out at Leigh; a 6,000-kw. turbo-alternator is required at Bristol; a small generating set for the East Sussex Asylum; new plant, £21,850, at Batley; transformers, switch-gear, and cable at Wigan; and electrical stores in various places (p. 221).

THE Hertford County Council will oppose any power scheme which interferes with their area.—Although the electricity profits at Bradford are less than were anticipated, £7,500 are to be handed over to the rates.—The Carnarvon Council will not agree to the suspension of the sinking fund by the National Electric Construction Co. (p. 222).

THE Treasury has sanctioned a new issue of capital by the S. Wales Electrical Power Distribution Co.—A 6 per cent. dividend is recommended by the E.C.C., and 15s. per share by Callender's Cable & Construction Co. (p. 222).

Arrangements for the Week.—(To-day) Thursday, May 20th.—Institution of Electrical Engineers. Meeting of Engineers' Volunteer Training Corps, who will be addressed by the Commandant, Lieut.-Col. C. B. Clay, and by Sir John Snell. 5 p.m.

Tuesday, May 25th.—Association of Supervising Engineers, St. Bride's Institute, Fleet Street, E.C. Annual General Meeting. 7.30 p.m.

Thursday, May 27th.—Institution of Electrical Engineers. Annual General Meeting. 8 p.m.

THE ELECTRICAL EMERGENCY SERVICE

ALTHOUGH we have received between two hundred and three hundred applications for enrolment in the Electrical Emergency Service, and have 107 names of suitable men entered on the register for the London district, yet we must appeal once more to our readers to enrol themselves in greater numbers. There are still a large number of switchboard attendants at the various electricity works and sub-stations who are suitable either for military duty or for work in factories making munitions of war. If their places are adequately filled by members of the Electrical Emergency Service, they will be free to leave, and help to make up the 300,000 men demanded by Lord Kitchener on Tuesday.

Large numbers have left for the Army already, a few have gone to engineering works, and we have sent members of the Electrical Emergency Service to replace several of them at the switchboard. In some cases, electrical engineers who have retired, or practically retired, from active work have come forward and have generously taken on these jobs to meet the emergency, working full shift just as the ordinary switch hands. Other members, whose business or occupation has been reduced under war conditions and has left them with time on their hands, are working four hour half shifts daily in central stations or sub-stations, while the greatest number have volunteered for the "special constable" hours of half-shifts nightly on alternate nights. It is obvious that four of the latter are required to release or replace each full-shift switchboard attendant, and it is equally obvious that, for working in the midnight hours, the volunteers must be men living near the stations or sub-stations. Some of the people on our register are still unplaced, owing to there being no call at present in the particular district in which they reside, but others are living in

districts in which their services are required but are being kept waiting for more enrolments in order that the groups of four may be made up. We want every electrical engineer in London who will give four hours a day, or four hours on alternate nights, to become enrolled, and we want them most urgently in the following districts: Hammersmith, Wandsworth, Tooting, Streatham, Clapham, Stockwell, Battersea, Camberwell, Holborn, Camden Town, Islington, Mildmay Park, Clapton, Hackney, Limehouse, Woolwich, Lewisham, and Forest Hill. Although this list is a long one, it by no means represents the whole of the requirements; but in these districts the demand for assistance is being acutely felt.

Moreover, it is the *good* men we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees, but who are willing now to defer their rest a little longer in view of the national emergency.

Those gentlemen who have sent in their applications for enrolment, and are still waiting for their services to be called upon, will, we are sure, understand the circumstances explained above. Many will be called upon to take up their duties during the next few days, and although in other cases it may be some little time before the difficult task of fitting in the remainder may be completed, it is more than probable that the services of most of those on our register will ultimately be most welcome.

Applications for enrolment, on the form below, should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

ELECTRICAL EMERGENCY SERVICE APPLICATION FORM.

(Please cut out, fill in, and return to the Editor of "Electrical Engineering," 203 Temple Chambers, London, E.C.)

I wish to be enrolled as Member of the Electrical Emergency Service.

Age..... Married or Unmarried.....

Qualifications (state electrical experience)

.....
.....
.....

I am willing to work a full shift as (A) (below),

a half shift as (B), (C), (D).

(Delete the line and letters not applicable.)

My regular occupation prevents me at present from giving electrical emergency service between..... a.m. and..... p.m.

Signature

(Please write very distinctly, and give addresses very fully.)

Residential Address

Business Address.....

The Service Required.

- A. A full eight-hour shift a day, or—
- B. A half-shift (four hours) daily (1st week morning, 2nd week afternoon, 3rd week night, in rotation).
- C. A half-shift every day, without midnight work.
- D. A half-shift alternate nights with no day work.

To prevent any suggestion of competition with regular employees, wages will be paid in proportion to the existing rates at the works at which the member is employed, and to the time given.

A week's notice will be required from any member leaving the Service.

NEW COUNCIL OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE result of the ballot for officers and Council of the Institution of Electrical Engineers (see ELECTRICAL ENGINEERING, April 1st, p. 139) has been the election of the following:—**President:** Mr. C. P. Sparks. **Vice-Presidents:** Dr. A. Russell and Mr. Roger T. Smith. **Hon. Treasurer:** Mr. Robert Hammond. **Ordinary Members of Council:** Messrs. W. A. Chamen, H. Dickinson, J. Hunter Gray (Associate), Prof. T. Mather, Messrs. H. F. Procter, and C. S. Ram.

The full Council also includes the following who did not need re-election:—**Vice-Presidents:** Messrs. J. S. Highfield and C. H. Wordingham. **Members:** Messrs. R. A. Chattock, J. Christie, Prof. B. Hopkinson, Messrs. G. W. Partridge, W. H. Patchell, R. J. Wallis-Jones, and W. B. Woodhouse. **Associate Members:** Messrs. F. E. Berry, Major E. O. Henrici, R.E., and Mr. A. W. Martin. **Associates:** Messrs. E. Russell Clarke and A. M. Ogilvie, C.B.

THE INSTITUTION REPORT

THE Annual Report of the Council of the Institution of Electrical Engineers, which will be submitted at the annual general meeting on May 27th, records a total membership of 6,811, which is a decrease of 234 since last year, due mainly to a diminution in the number of students owing to the war. The following military distinctions have been awarded to members:—Brigadier-General A. M. Stuart, R.E., has been mentioned in despatches and awarded a C.B.; Commander E. G. Robinson, R.N., was promoted to that rank for distinguished service at the Dardanelles; and 2nd-Lieut. C. W. Williamson (3rd Manchester Reg.) has been awarded the Military Cross. The following have died on active service:—Sapper J. A. Donald, R.N.D., H. Labour (French Army), Major H. S. Marsh, R.E., Sec.-Lieut. J. L. Moffet (3rd Royal Scots Fusiliers), Sapper W. W. Pullen, R.N.D., Capt. G. L. Slater, R.N. (H.M.S. Bulwark), and Sec.-Lieut. E. W. Wilson (West Yorkshire Reg.).

PREMIUMS, PRIZES, AND SCHOLARSHIPS.

The following awards have been made:—

The Institution Premium (£25) to Mr. C. J. Beaver, for his Paper on cables.

The Ayrton Premium (£10) to Mr. J. H. Rider, for his Paper on power supply to the Central Rand Mines.

The Fahie Premium (£10) to Mr. H. G. Brown, for his Paper on the signalling of a rapid transit railway.

The John Hopkinson Premium (£10) to Mr. E. B. Wedmore, for his Paper on automatic protective switchgear.

The Kelvin Premium (£10) to Dr. S. P. Smith and Mr. R. S. H. Boulding, for their Paper on the shape of the pressure wave.

The Paris Premium (£10) to Mr. C. P. Sparks, for his Paper on electricity as applied to mining.

An extra premium (£10) to Mr. W. M. Selvey, for his Paper on power plant testing.

An extra premium (£5) to Mr. N. Shuttleworth, for his Paper on polyphase commutator machines.

Students' premiums have been awarded to Mr. H. Hobson (£10), for his Paper on utilisation of waste heat; to Mr. A. Arnold (£5), for his Paper on condensing plant; and to Mr. H. S. Marquand, for his Paper on electric welding.

Salamons Scholarships (£50) have been awarded to Mr. L. M. Barlow (Finsbury) and Mr. C. D. Farmer (City and Guilds Engineering College), and a David Hughes Scholarship (£50) to Mr. P. D. Morgan (King's College).

Wiring Rules and Research.—A revision of the Institution Wiring Rules is now in progress, and the Research Committee, in addition to progress with work in hand connected with magnet steels, heating of buried cables and insulating oils, are also considering the maximum current densities which can safely be allowed on conductors of various cross-sectional areas.

National Service.—The Institution at the commencement of the war initiated a scheme by which members were invited to place their services at the disposal of the Army, Navy, and Public Services, with the result that over 1,600 offers were received, including 500 for active service in the Forces, and were placed at the disposal of various Government Departments. A scheme for supplying emergency men to electric supply undertakings was also initiated, but not proceeded with to any great extent.

Mr. A. P. Trotter also suggested a scheme for the formation of a special battalion of members of professional bodies, but before any steps had been taken a request was received from the Admiralty to recruit about 670 men for the Engineer

Units of the Royal Naval Division, and, in conjunction with the Institutions of Civil and Mechanical Engineers, a recruiting office was established at the Institution, and through the labours of a Committee of Selection, consisting of Major-Gen. R. N. Ruck, Mr. W. Duddell, Mr. R. Hammond, Col. O. E. Ruck, and Mr. A. P. Trotter, this corps was fully recruited by the middle of October. In the meantime, Mr. Trotter's original scheme was not proceeded with.

The Institution has placed extensive accommodation on the first floor of its building at the disposal of the War Office and Admiralty free of rent.

In addition to recruiting the Engineer Section of the Royal Naval Division, the Institution has, at the request of the War Office, recommended a large number of suitable candidates for temporary commissions in the Royal Garrison Artillery; and the President has also nominated some of the members for special temporary commissions in the R.E.

In all, 92 members, 405 associate members, 55 associates, 64 graduates, and 312 students, making a total of 928, are serving in the Navy or the Army.

The Council is also taking steps with a view to the formation of an Engineers Volunteer Training Corps, and some 150 members have already expressed their willingness to join.

The Enemy's Trade.—Soon after the outbreak of war a Committee was formed to keep in touch with the B.E.A.M.A. in regard to the question of securing for British manufacturers the trade hitherto done by Germany and Austria-Hungary, but eventually it was concluded that the Institution could take no useful action in the matter.

Period for Repayment of Municipal Loans.—The Committee appointed last year to consider this matter has continued its inquiries, and has come to the conclusion that good grounds exist for approaching the Local Government Board to sanction periods of thirty years in the case of underground cables, sixty years for conduits, fifteen years for batteries, and thirty years for reinforced concrete, and representations will be made to the Local Government Board on these lines.

OBITUARY

George Maurice.—Among the passengers on the *Lusitania* was Mr. G. Maurice, a Director of the General Electric Co., Ltd., and, as no news has been had of him, it is now practically certain that he has lost his life. Mr. Maurice has been with the General Electric Co. for seventeen years. He was at first assistant to Mr. M. Railing in London, and, when Mr. Railing went to Witton to take charge there in 1902, Mr. Maurice was placed in charge of the fittings department in London. A few months ago he was appointed a Director of the Company. Mr. Maurice had many friends in the electrical industry, and his loss will be much regretted. He leaves a widow and one child.

Audley Drake.—Another passenger drowned on the *Lusitania* was Mr. Audley Drake, the elder son of Mr. Bernard Drake, Chairman of Drake & Gorham, Ltd. Mr. Audley Drake was not himself a member of the firm.

Stanley Bastian.—Second-Lieutenant Stanley Bastian, 4th Batt. Seaforth Highlanders, son of Mr. C. Orme Bastian, was killed in action on May 9th. He was twenty-three years of age, and an only son, and our readers will sympathise with Mr. Bastian in his bereavement.

THE ELECTRICAL WHOLESALERS' FEDERATION

An association of this name has been formed "to promote and protect the interests of wholesale dealers in and factors and suppliers of electrical goods and appliances; to promote the consideration and discussion of all questions affecting the wholesale electrical trades; to procure, circulate, and supply information (including status information); to obtain the most favourable terms and rates from manufacturers of goods and from railway and shipping companies and other carriers; to encourage the settlement of disputes by arbitration; to act as or nominate arbitrators and umpires; to promote displays of electrical goods, machinery, appliances, and fittings and drawings of the same at national and international exhibitions; and generally to watch over and protect the interests of persons engaged in selling electrical goods and appliances."

We understand that several prominent firms have joined it, and all wholesale dealers in or factors or suppliers of electrical goods and appliances are eligible as members. The manager is Mr. F. Sumner Smith, of the Electrical Equipment Company, Amberley House, Norfolk Street, Strand, W.C., and among the other gentlemen who are associated with it are Messrs. Morton Beales (Gillespie & Beales), A. G. Beaver (Sun Electrical Co.), F. Pooley (Pooley & Austin), R. W. Smith (Drake and Gorham), G. O. Donovan (Birmingham), and P. L. Davies (Downes & Davies, Liverpool).

Further particulars will be announced later.

ELECTRIC SUPPLY AT WOOD GREEN

THE statutory powers for the supply of electricity in Wood Green conferred upon the District Council in 1902 were transferred in 1913 to the Tottenham District Light, Heat & Power Co. The scheme prepared for this Company by their Consulting Engineers, Messrs. May & Hawes, was put in hand at once, and, in spite of delays due to the builders' strike and the war, the generating works and mains were ready and supply was commenced Christmas Eve, 1914. The area of supply embraces the whole of the Urban District of Wood Green, and has an area of 1,625 acres, with a population of 50,000, but one of the largest business establishments in the district, that of Edmonds, Denham & Goyder, Ltd., has its own generating plant of 240 kw. The supply is given on the direct-current three-wire system at 240 volts for lighting and heating, and 480 volts for power and special purposes. For small power requirements, where the demand does not exceed 3 kw., the supply is at 240 volts.

The generating station contains gas-driven plant, and is situated in Kingslade Road, at the rear of the Company's local offices. Town gas is supplied from the Tottenham works of the Company through a 12-in. main and a special meter. The station is a steel structure filled in with brickwork. It comprises three bays, the centre forming the engine-house. The ground floor of one of the side bays provides accommodation for the switchgear and the fitters' workshop, above which is the battery room. Water-cooling plant and silencers occupy the other bay, the water-softening plant, storage tank, offices, and stores being situated on the upper floor.

Two generating sets have already been erected, one of 100 kw. and the other of 200 kw. capacity, and accommodation has been provided for two additional sets of larger capacity. There is also a battery capable of giving 100 kw. for three hours or 200 kw. for one hour. Both these sets are driven by high-speed vertical five-cylinder gas engines built by E. S. Hindley & Sons (Bourton), running at 350 and 450 r.p.m. respectively. Compressed air is used for starting the engines, taken from a battery of four receivers charged by a motor-driven compressor. Circulating water for the engines is supplied from a tank of 1,600 gallons' capacity on the first floor. By interlocking gear the starting up of the engines without first turning on the water is rendered impossible. From the engine-jackets the water flows into two Heenan rotary water-coolers capable of dealing with 4,000 and 2,000 gallons of water per hour respectively. The water is returned to the storage tanks by means of electrically-driven centrifugal pumps. The make-up water is controlled by a ball valve on the tank, and all the water used is first treated by a Boby water-softening plant of 300 gallons capacity.

The engines are directly coupled to "tandem" direct-current dynamos of the Electric Construction Co.'s make. The dynamos are of the multipolar shunt-wound type with interpoles. The armatures of each set have been made strictly interchangeable even to the provision of a coupling outside the outboard bearing, which is protected by a cover of planished steel. The dynamos are designed to generate current at any voltage from 250 to 280.

The battery, which was supplied and erected by the Chloride Electrical Storage Co., Ltd., of Manchester, consists of 270 "Plantide" cells. Each has 29 plates. For charging the battery there is a double-ended booster of the Electric Construction Co.'s make. The two boosting dynamos each have a capacity of 19 kw., and are driven by a 58.b.h.p. 500-volt motor running at 1,200 r.p.m.

The switchboard, which also came from the E.C.C. works (Wolverhampton), consists of two generators, one battery and booster, one integrating watt-hour meter, and three feeder panels, all of black enamelled slate. The panels are divided horizontally at the centre by a slate shield, the top half being devoted entirely to the positive side of the system, and the lower half to the negative. All the circuits are protected by automatic cut-outs, and, where suitable, time-lag attachments are provided. The whole of the instruments are of the "Cirscale" type, manufactured by the Record Electrical Co., Ltd. (Manchester).

The regulating gear has been kept entirely separate from the board. The resistances are placed in a cellar, into which all the cable connections from the generators and boosters come, and also the feeder cables. Immediately above the resistances the control pillars, eight in number, including two for the battery-regulating switches, are mounted on the engine-room floor. By this arrangement it is possible for the switchboard attendant to have control of all the generating plant and at the same time to be able to see the whole of the switchboard instruments. An earth panel with an Everett-Edgcumbe disc recording ammeter, short-circuiting relay,

and overload breaker is fixed on the wall at the back of the board.

Under the contract the consumption of gas by the generating sets working at ordinary full load, with gas of 500 net B.Th.U. per cubic foot at a normal temperature and barometric pressure, is guaranteed not to exceed the following:—For the 200-kw. set 30·75 cubic ft., and for the 100-kw. set 31·35 cubic ft. per unit generated as registered by watt-hour meters. The official consumption tests have not yet been taken, but we understand that the trials of the plant and their general running on the load give warrant to the view that the guaranteed results will be excelled.

All the cables are of the three-core type, insulated with impregnated paper, lead-covered and steel-armoured. They were made at the factory of the Western Electric Co. at Woolwich. There are three feeding centres where the feeder mains serve the distributors—one situated near the Town Hall, one in the High Road adjacent to Noel Park Station, and the other in the Alexandra Park district near the junction of the Avenue and Alexandra Park Road. At these centres feeder pillars have been erected, and similar pillars in other situations provide an easy means for dividing up the network of distributing mains into suitable sections. All the pillars, service-boxes, and consumers' fuse-boxes have been made by Messrs. Lucy & Co. (Oxford). The meters for registering the supplies taken by the consumers, as well as the main meters at the generating station, are by Messrs. Chamberlain & Hookham, of Birmingham.

The prices charged by the Company for electricity range from 5d. to 4½d. per unit for lighting purposes, and 2d. to 1d. per unit for power purposes. Meters for registering the supplies are provided and maintained by the Company at a quarterly rental of two shillings.

It may be mentioned that the capital expenditure on the scheme, including Parliamentary costs, land, generating station, and mains, amounted to about £30,000. The responsibility for the preparation of the scheme and for carrying it into effect is shared by Mr. A. E. Broadberry, Manager of the Tottenham District Light, Heat & Power Co., and Messrs. May & Hawes, Consulting Electrical Engineers (Caxton House, Westminster), to whom our thanks are due for these descriptive particulars. The duties of directing and supervising the constructional operations have been performed by Mr. J. Fisher, Assistant Manager of the Company, and Mr. L. W. Ballard, Chief Assistant to the Consulting Electrical Engineers.

University of Bristol.—A new temporary residential college capable of accommodating 29 students will shortly be opened in two houses in Belgrave Road, Tyndall's Park, which have been taken for the purpose by the University.

South Wales Wiremen's Wages.—At a conference last week between the South Wales electrical contractors and the Electrical Trades Union, Mr. H. Collings Bishop presiding, it was agreed that the rate of pay of wiremen in the Cardiff and Barry districts should be immediately raised to 9½d. per hour, with a further increase to 10d. on November 1st. Armature winders are to have an immediate increase to 10d. per hour, rising to 11d. per hour on November 1st.

University College, London. A new edition of the University College, London, "Pro Patria," is in course of preparation, and will be issued shortly. Past and present students, or their relatives and friends on their behalf, are invited to send full particulars of the capacity in which they are serving the country at the present time. In the case of the Army, rank and regiment should be given; in the case of the Navy, rank and ship. These particulars should be addressed to the Publications Secretary, University College, London (Gower Street, W.C.).

The "Electric Dog."—The *Electrical World* describes a curious piece of apparatus made by an American student consisting of a little box mounted on three wheels and electrically driven and steered. The control is by means of a pair of selenium cells, in conjunction with suitable relays, &c., which form the "eyes" of the dog. The dog's master has only to point an electric torch towards his pet, and the motor starts up, causing it to run to him, the steering being effected according to the relative amount of light falling on each selenium cell, so that the dog always makes straight for the light. The inventor has applied the same principle to a burglar alarm, which rings bells, fires a revolver, and ignites a flash-light powder to photograph the burglar as soon as his lantern is pointed to it. He also hopes to construct a dirigible torpedo which will steer itself towards any searchlight falling on it.

CONCENTRIC HOUSE WIRING IN THE UNITED STATES AND CANADA

MAKERS of concentric systems of house-wiring should keep in touch with the position which is developing in the United States and Canada, in which countries considerable attention has been given to concentric wiring systems during the past two or three months. Although there, as in this country, wiring with rubber wires in conduit is recognised as the best practice, yet other methods are in use; a great deal of work is still carried out in wood casing, the very simplest open cleat wiring is by no means unknown, and "Stannos" wire has been introduced to some extent. There has recently been a movement on foot, however, to obtain a revision of the "National Electric Code" with which house-wiring in the United States and Canada must comply, to permit the use of the concentric system with bare return; and, as the supply voltage of 110 is largely in use on the American continent, some considerable support has been given to the proposal, although there has been quite a controversy in electrical circles in America with regard to it.

The Electrical Committee of the National Fire Protection Association, the body issuing the "National Electric Code," appointed a sub-committee to report on the subject of "Grounded Concentric Wiring Systems," and the report, issued to the American electrical Press last February included a set of suggested rules, preceded by the following very cautious note:—"The rules suggested are for experimental and development purposes, are only a partial outline of possible future requirements, and are subject to revision, modification, and extension. A system fulfilling the conditions outlined will not necessarily be acceptable. Suggestions for the further development of similar systems are invited. All appliances and systems should be submitted to underwriters' laboratories for examination and report." The Committee further disclaimed any intention of actually recommending that these rules should be included in the "National Electric Code."

Although this report has been subsequently withdrawn, in view of a further development which threatens ultimately to keep the manufacture of this class of wire in American hands, we may refer briefly to the main points in the rules. The system (using the uninsulated outer sheath as the return conductor, as already mentioned) is limited to exposed work on "normally grounded" supply systems with a voltage under 150 above earth. When passing through a floor, the wire is to be carried through an iron pipe extending at least 3 in. above the flooring, and "additional mechanical protection may be required by the inspection department." The radius of the inner edge of any bend is not to be less than $3\frac{1}{2}$ in. The fittings for the outlets must be "approved," and connections to the sheath must not be soldered but must be made with clamping devices. No switches or fuses are to be placed on the outer sheath, which must be electrically and mechanically continuous and bonded to any gas or water pipes with which it is liable to come in contact.

It might well be thought that these rules would give sufficient safeguards, but the Committee at the same time requested American manufacturers to submit samples of the wires and fittings. The American manufacturers took up the matter with interest—possibly with all the greater interest as they probably knew that two or three well-tried English-made systems had been on the market for several years. They undertook to make experiments and to submit samples, and the upshot of the matter was that, at the end of March, when a big four-day meeting was held for the purpose of the biennial revision of the National Electric Code, the above report was withdrawn and another "substitute report" submitted, stating that the report of the Committee appointed by the Associated Manufacturers of Electrical Supplies had been received, and requesting the co-operation of that organisation in future consideration of the subject.

So far as we can judge, with our limited knowledge of the complex procedure followed in connection with the revision of the "National Electric Code"—which it must not be forgotten is the only set of wiring rules accepted at present by the Fire Insurance Companies in Canada as well—the position is now that the alterations permitting earthed concentric wiring systems to be used generally cannot come in force for another two years, during which time the American manufacturers should be very ready to meet the demand for material. There is then, however, likely to be a big field for this class of wiring in the two countries, and we recommend British manufacturers not to let the matter rest in the meantime.

ELECTRIC DRIVING IN A SAW MILL

THE application of the electric drive to the machinery installed in sawmills is a comparatively simple problem, as sawmill machinery rarely calls for speed control, and merely requires a motor running at constant speed continuously throughout the working hours. With steam driving it has been customary to burn the refuse for heating the boilers, but with the installation of electric motors the refuse can be sold, and it is found that there is a ready market for it. Naturally in a sawmill there is a considerable amount

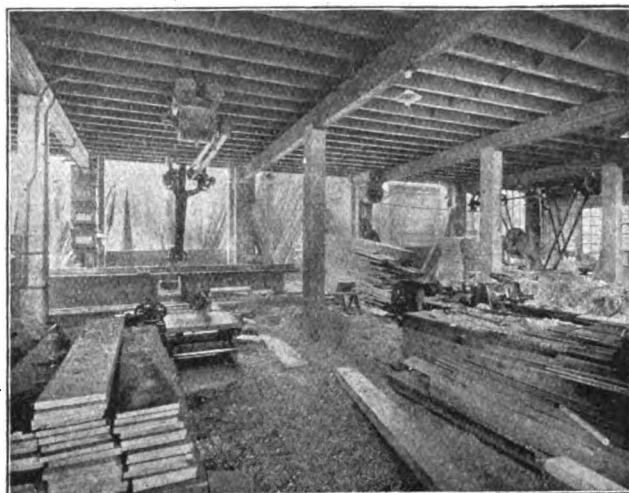


FIG. 1.—CROSS-CUTTING CIRCULAR SAW DRIVEN BY MOTORS MOUNTED ABOVE.

of dust, but in a well-designed installation this does not militate against the successful application of electric drive. An interesting installation of this nature is that at Mr. Geo. Shipway's Electric Sawmills, Camp Hill, Birmingham.

In this installation three-phase power at 25 cycles, 440 volts, supplied from the mains of the Birmingham Corporation, is distributed from an ironclad switchboard to a number of "Witton" induction motors of the open type, varying in size from 50 h.p. downwards. The mills are situated in one of the busiest parts of Birmingham, where space is valuable, and how the electric motor lends itself to compact arrangement is seen from the illustrations. Two of the motors are shown in Figs. 1 and 2 mounted on the ceiling, one driving a cross-cutting circular saw, while the other drives



FIG. 2.—A GROUP OF MACHINES DRIVEN FROM ONE MOTOR, COMPRISING BAND SAW, SAW SHARPENER, GRINDER, SPINDLE MACHINE.

a group of small machines consisting of band saws, saw sharpeners, grinders, and spindle machine. The other motors are installed in concrete pits directly below the machines they are driving. One works a circular saw seen in Fig. 3, a second a further circular saw, and a third a four-cutter machine trimming the four surfaces of the wood at the same time. In each case the controlling switchgear is situated close to the driven machine. The whole of the floor space

is available for the ordinary operations, and in no case is space taken up by belting or shafting. Mr. Shipway is emphatic as to the economy obtained by the introduction of electric driving into his mill, and regards as one of the most valuable features the ability to shut down those of the machines which are not in use, and, in addition, to run

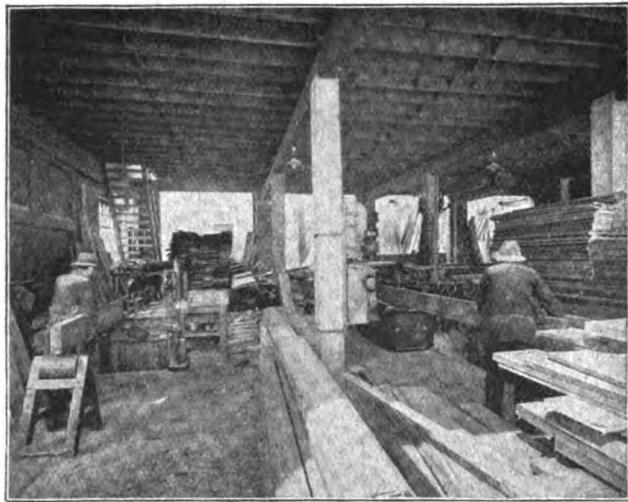


FIG. 3.—CIRCULAR SAWS DRIVEN BY MOTORS IN PITS BELOW.

one or more machines as desired through the breakfast-hour or on overtime should a pressure of work make such a procedure desirable. The whole of the electric plant for this installation was supplied by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), who are indebted to Mr. Geo. Shipway for permission to send us particulars of the installation.

A BROKEN SHAFT AT BARKING

ON Tuesday last week, at about 4 p.m., the A.C. supply from the Barking Electricity Works was suddenly stopped by the breakage of a 5½-in. crank shaft. The machine upon which the accident occurred was a reciprocating set driving a 250-kw. D.C. set and a 250-k.v.a. A.C. set in tandem. Smoke was observed coming up from the alternator, and on the set being shut down it was found that the break had occurred on the edge of the end bearing of the engine, and that the bearing metal had melted. As the bulk of the supply from the Barking Electricity Works is D.C., and A.C. is only used for some power circuits, only part of the supply was crippled, but the A.C. consumers had to suffer, as the only other A.C. set is a 130-kw. motor-generator, which is not sufficiently large to take the maximum A.C. load. It will be seen, therefore, that the set which broke down was a very useful one, and, in fact, it has been running almost continuously. We learn that Messrs. Siemens Bros. Dynamo Works are lending a starting apparatus, which will enable the generators of the A.C.-D.C. set to be used as a motor-generator, and as there is at present enough D.C. capacity in the station, it is probable that by the time this note appears the supply at Barking will be quite normal. East Ham has also offered to supply the traction load if necessary, as the Barking and East Ham tramways join one another. As, however, there is a probability of the load increasing considerably during the next few months, owing to the requirements of works engaged on Government contracts, and four months will elapse before the repair to the engine is completed, the L.G.B. is being asked to sanction expenditure on new plant. Mr. W. E. Kidner, who is Acting Engineer and Manager of the works in the absence of Mr. W. Holmes, who is with the Army, will be responsible for the extensions.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Principles of Electrical Measurements. By A. W. Smith. 243 pp. 7½ in. by 5 in. 99 figures. (New York : McGraw-Hill Book Co.; London : Hill Publishing Co., Ltd.) 8s. 4d. net.

We can give our thorough endorsement to Prof. Smith's principles. They are clearly given, and the diagrams illus-

trating them are excellent. In some cases—for instance, in the chapters on the Wheatstone bridge—the author goes a little further than the title of his book might imply, and describes not merely the various methods of measurement, but their practical application to concrete cases, and this might with advantage have been developed throughout the book by giving details of the usual methods employed in the commercial testing of electrical machinery, apparatus, and circuits. A student whose knowledge of electrical measurements did not extend beyond the limits of this text-book would certainly not be able to make the reception tests of a generator or motor, and he might even feel "at sea" in the testing-room of a cable factory, for, while the loss of charge method of insulation testing is described, the more common "direct deflection" method is not deemed worthy of mention. Nor is the principle of the various ohmmeter insulator testing sets included. We are also surprised to see that the Kelvin double bridge is not described. Although the measurement of low resistances may now be more usually made by the simple ammeter and voltmeter method, yet the double bridge certainly has equal if not greater claim for recognition than the obsolete tangent galvanometer of "historical interest." One of the measurements described in the first chapter on the Wheatstone bridge is a method of localising the position of a break in a wire of a multiple telephone cable by comparing the capacity of the faulty pair to a sound pair by a bridge method, and it would be interesting to know whether the utility of this has been confirmed in actual practice, as the accuracy would appear to be considerably greater than with the usual method of comparing the discharge swings.

Electrical Instruments in Theory and Practice. By W. H. F. Murdoch and V. A. Oschwald. 336 pp. 7½ in. by 5 in. 164 figures. (London : Whittaker & Co.) 10s. 6d. net; abroad, 11s.

There is perhaps a little more of the theory than the practice in this book, which is addressed to "students in the higher classes" as well as engineers. The subject of damping is mathematically treated at some length before the principles of moving coil, iron cored, hot wire, and dynamometer type instruments are discussed. The action of various patterns of supply meters forms material for a considerable portion of the work, and the principal methods of magnetic testing are briefly recapitulated. The final chapter, somewhat ineptly named the Post Office Box, discusses resistance bridges, potentiometers, &c., but on account of the simplicity of the theory of their action, this part of the subject is rapidly passed over. Another volume on oscillographs and further A.C. instruments is promised. The work does not profess to deal with practical details of the instruments themselves, but is rather of value in inculcating and understanding of the problems underlying their action.

The Year Book of Wireless Telegraphy and Telephony, 1915. 800 pp. 8½ in. by 5½ in. 44 figures. (London : The Wireless Press, Ltd.) 3s. 6d. net; by post 3s. 11d.; abroad 4s. 6d.

In the 1915 issue, this valuable work of reference, published under the auspices of the Marconi Company, has been thoroughly brought up to date. It contains an interesting chronological summary of the development of wireless telegraphy, and reprints the last of the Radiotelegraphic Convention, and that dealing with safety of life at sea. The various laws and regulations in force in foreign countries are also dealt with, and complete lists of wireless stations are given, with an excellent map. Among the series of original articles is one by Mr. A. Hurd on "Wireless and War at Sea," while Col. F. N. Maude writes on the influence of wireless telegraphy on modern strategy. The technical articles include one from the pen of Prof. J. A. Fleming on "The function of the earth in radiotelegraphy," and a summary of progress in wireless telephony by Mr. H. J. Round. Dr. W. H. Eccles contributes an article on "Radiotelegraphic research in 1914," and other subjects dealt with include long-distance service, meteorology, and time signals. There is also a collection of biographical notices, and particulars of companies connected with wireless telegraph work, and a host of technical and statistical information.

The Arithmetic of Electrical Measurements. By W. R. P. Hobbs. Revised and edited by A. P. Palmer. 120 pp. 7½ in. by 4½ in. 20 figs. (London : T. Murby & Co.) 16th edition. 1s.; by post, 1s. 2d.

This book has fully deserved its fifteen editions. The present edition the sixteenth—has been revised by Mr. A. R. Palmer, and considerable additions have been made, including a practical chapter on curve plotting. While revising the work, however, it is to be regretted that a section was not also added on fall of potential calculations.

Electric Light Accounts and their Significance. By H. M. Edwards. 172 pp. 7*½* in. by 5 in. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 8s. 4d. net.

The author is the auditor of the New York Edison Co., and therefore an authority on the subject, but the system described is directly applicable only to American conditions.

Improved Four-figure Logarithm Tables. By G. C. McLaren. 27 pp. 8*½* in. by 5*½* in. (Cambridge: The University Press.) 1s. 6d. net; by post 1s. 7d.

A set of tables of four-figure logarithms are arranged in very convenient form in 18 pages with a thumb index, and accompanied by clear and concise explanatory remarks as to their use.

Business Methods and the War. By L. R. Dicksee. 71 pp. 9 in. by 5*½* in. (Cambridge: The University Press.) 2s. net; by post 2s. 2d.

This is a reprint of four lectures given by the author (who is Professor of Accounting and Business Organisation in the University of London) at the London School of Economics. The first contains an interesting comparison of military and civilian methods of organisation, bringing out several fields where the one might with advantage learn from the other. In the second lecture a plea is put forward for training methods more nearly approximating to drill for improving efficiency in civilian occupations, while improvement in accounting methods is discussed, and other financial questions form the subject of the last. The work is most stimulating reading and is full of the soundest common sense, and is a welcome relief to the irresponsible and unpractical scaremongering style of writing only too prevalent just now.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,443.

What are the usual faults met with on three-core, paper-insulated, earth-shielded, and lead-covered cable supplying energy on the three-phase E.H.P. system with insulated neutral, the feeders being drawn in earthenware pipes?—"FLOTSAM."

(Replies must be received not later than first post, Thursday, May 27th.)

ANSWERS TO No. 1,441.

Are small continuous-current fan motors series or shunt wound, and why?

The first award (10s.) is made to "KOIL" for the following reply:—

It is impossible to predict accurately the performance of a fan owing to differences of trunk area and length, bends, &c., and it is therefore desirable that the motor driving the fan should, as far as possible, adjust itself to compensate for differences from the estimated conditions. For example, if the effective resistance of the trunk is higher than anticipated, at a given speed less quantity of air will flow, and consequently the load will be reduced, a higher speed being required to give the increased pressure necessary for the desired quantity of air. If the motor is series wound, the speed will increase until the load is such that the armature current is the same as the exciter current required for that

speed; whereas the speed of a shunt-wound motor will only increase very slightly. Conversely, if the resistance of the trunks, &c., is lower than anticipated, an excess quantity of air will flow, tending to overload the machine, but a series motor will automatically slow up, thus reducing the air pressure, and incidentally the quantity, until the current demanded by the load and that demanded for excitation is the same; whereas the shunt motor under similar circumstances would run at approximately normal speed and maintain the overload with the consequent dangers.

Very small series-wound motors, such as those used for desk and ventilating fans, are easier to construct and are better than shunt-wound motors, particularly if they are required for mediumly high voltages. The number of armature conductors required is less for a small series motor than for a shunt machine of the same dimensions, owing to the applied voltage across the armature being less, since there is quite a considerable drop voltage across the series field coils (as much as 20 to 30 per cent. of the line voltage in some cases). This permits the use of heavier wire on the armature, and, further, the field coils can be made of many fewer turns and of larger wire than if shunt wound—both important points on such small machines. If no speed control is required, or when the capacity of the sets is small enough for plain series regulation, the wiring for series motors is the simplest possible, only two wires being required between the motor and the switchgear and mains, whereas in a shunt motor three are required. For larger machines, however, when speed regulation is required, pure series control is, of course, most uneconomical, and it is often desirable from the point of view of efficiency to put in a larger motor, either shunt wound regulated by resistance in the field circuit or series wound with series-diverter control, in which case, of course, the wiring for the shunt motor is less expensive. It might be mentioned that speed reduction by series resistance is usually more economical for shunt motors than it is for series motors, but for small equipment this saving is quite counterbalanced by the other advantages obtained by using the series motor.

The second award (5s.) is made to "T. C." who writes as follows:—

Small continuous-current fan motors are series wound, and not shunt wound, for the following reasons:—If shunt wound, the field winding would be excited from the full-line voltage, whereas if series wound the field winding has only a portion of the line voltage between its terminals. The consequence is that the necessary ampere turns are got by using a larger wire with a series winding than with a shunt winding. Fewer turns are required, so the winding process is cheaper. The space factor will almost certainly be better, so more copper can be got into the winding space, leading to a possible increase of output or an improvement in efficiency. As the difference of potential between the terminals of the coils is less, the chance of breakdown is diminished. The price of copper wire goes up very rapidly, in the case of small diameter wires, as the diameter becomes less and less. Hence the copper for winding the coil is itself cheaper per pound, almost certainly sufficiently cheaper to make the coil itself cheaper in material, even though a greater weight of copper be used with the better space factor.

If shunt wound, the armature winding would be across the full potential, whereas if series wound the armature winding has only a portion of the full potential across it. Hence its back E.M.F. is reduced, which means that the number of turns required in its winding is reduced also. As in the case of the field winding, a larger wire is therefore required, giving exactly the same advantages as regards less cost of winding, space factor improvement leading to increased output or efficiency, less difference of potential between various parts of the winding, and less cost of material. If the question of commutation should be important, e.g., if the fans are for high voltages, the reduction in the number of turns helps greatly in this direction also.

As, presumably, only open-air fans are referred to, it is unlikely that great changes of load will occur, and hence, in practice, even the series-wound motors will run at very constant speeds. But even if the load should change owing to alteration of surrounding air paths and pressures, the series-wound motor will have the advantage over the shunt-wound motor that it will tend to run at a constant load. Should the pressure increase, its speed will diminish, thus giving the effect indicated. But a shunt-wound motor, with a more constant speed, would tend to become overloaded under the same circumstances. This is, however, a minor point; the important items are summarised above, and are those concerned with cost of production and reliability.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 13th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

17,889/13. **Switches.** A. HIRST and P. S. BROOK. Iron-clad switches in which the iron case is divided into two compartments, one containing the main working parts that periodically require attention, and the other the live terminals and an isolating switch operated from outside and interlocked with the main switch and the cover of the main compartment. (Four figures.)

9,123/14. **Conduit Joints.** SIMPLEX CONDUITS, LTD., and L. M. WATERHOUSE. Joints for conduit tubes and fittings in which an internally screwed and flanged sleeve is made by turning over the plain part of the sleeve after partially threading the interior. The bore at the end of the sleeve is enlarged before threading to give clearance for the tap, and so that space is provided for a bell mouth at the end of the tube to take its proper seating against the fitting. (Seven figures.)

9,554/14. **Cables.** C. J. BEAVER and E. A. CLAREMONT. Cables insulated with a mixture of vulcanised bitumen and vulcanised or unvulcanised rubber, gutta-percha, mucilaginous gum or gelatine, the latter ingredient forming from 5 to 15 per cent. of the whole.

9,637/14. **Telephones.** E. C. R. MARKS (*Electrical Experiment Co., U.S.A.*). Transmitters with rigid diaphragm lightly supported by pneumatic cushions exerting an aperiodic resilience, and permitting the diaphragm to vibrate as a whole in accordance with the sound vibrations. (One figure.)

9,856/14. **Traction.** B.T.-H. CO. and F. W. CARTER. A continuous-current traction system with an insulated return conductor connected to the track at intervals, and to dynamotors or motor generators having the driving armature windings connected in series with the outgoing line, and the generating armature windings in series in the return conductor. (Two figures.)

10,050/14. **Commentators.** W. S. PYRAH. The interposition of a layer of lead or other rigid material which flows easily under heavy pressure between the V-ring holding the bars and the surrounding insulation. (One figure.)

10,440/14. **Cables.** R. R. STELL. A cable comprising one or more insulated cores separated and surrounded by a covering of bitumen compound, and covered by a further coating of hard rubber.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: PRICE and CALLENDER'S CABLE & CONSTRUCTION CO. [Cables] 8,842/14.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. CO. (*G.E. Co., U.S.A.*) [Motor control] 10,531/14; MIDGLEY and VANDERVELL [Commutators] 14,861/14.

Electrometallurgy and Electrochemistry: LIPINSKI [Preparation of hydrocyanic acid by the electric arc] 11,107/14; STROHMENGER [Electric welding and fusion deposition of metals] 13,538/14.

Incandescent Lamps: GIMINGHAM [Incandescent lamps] 2,323/14.

Switchgear, Fuses and Fittings: TUCKER and CRABTREE [Switches] 9,558/14; COLLIS and CROMPTON & CO. [A.C. control gear] 10,822/14.

Telephony and Telegraphy: DE LANGE and FISCHER [Thermic telephones] 4,220/14; DIXON [Printing telegraph receivers] 10,716/14; LYLE [Telegraph transmitters] 10,775/14; WESTERN ELECTRIC CO. (*Woodward for W.E. Co., U.S.A.*) [Selective signalling system for party lines] 10,807/14.

Traction: INRIG and GAVAN INBIG, LTD. [Car lighting] 24,219/13; W. R. SYKES INTERLOCKING SIGNAL CO. and TARRANT [Signalling relay] 10,504/14; PETER [A.C. track signalling] 10,533/14, and [Electrically worked points and signals] 10,534/14; ALEXANDER (*Union Switch & Signal Co.*) [Point control] 10,938/14; BRETTELL (*Apple Electric Co., U.S.A.*) [Car lighting] 20,168/14.

Miscellaneous: GOWER [Indicating speed ratio of co-related rotors or shafts for facilitating control of transmission] 5,843/14; PARSONS and BALL [Clocks] 10,015/14; DAVIS and

RAILING [Mine signalling relays] 10,549/14; BRISTOL [Miners' lamps] 11,599/14; JOHN DAVIS & SON, LTD., and DAVIS [Colliery signalling] 11,780/14; KROPP [Impulse-producing mechanisms] 12,913/14; GEHR. SULZER [Governors for internal-combustion engines having electric power transmission] 13,706/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear, &c.: GILES [Switches] 5,943/15.

Telephony and Telegraphy: ROUZET [High-frequency generators] 5,955/15.

The following Amended Specification can now be obtained:—
Telephony: D. H. KLEIN and J. W. TURNER [Exchange working] 6,369/13.

Opposition to Grant of Patents

4,655/14. **Ignition.** A. CHRISTMAS. Opposition has been entered to a grant on this specification, which describes a combined ignition coil and lamp for automobiles.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

10,505/01. **Storage Batteries.** T. A. EDISON. Batteries with an alkaline electrolyte having anhydrous ferrous oxide in the negative electrode and a depolariser of non-colloidal hydrated oxide of nickel in the positive electrode. The active material is rendered more conducting by the presence of flakes of graphite, and is contained in perforated receptacles, of which some of the constructive details are covered by this patent.

10,733/01. **Oil Switches.** B.T.-H. CO. This specification describes constructive details of a pattern of oil circuit breaker for hand operation and automatic release.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: J. S. HIGHFIELD [H.T., D.C. distribution] 1,946/06.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. CO. (*H. F. T. Erben*) [Brush holders] 2,666/02.

Ignition: H. A. HUMPHREY [Contact maker actuated by compression] 2,509/07.

Incandescent Lamps: B.T.-H. CO. (*G.E. Co., U.S.A.*) [Machine for flashing filaments] 2,456/04; H. ZERNING [Preparation of metal filaments from hydrides and nitrides] 2,554/06.

Switchgear, Fuses and Fittings: A. P. & G. C. LUNDBERG [Tumbler switches] 2,251/03; A. LOEBL and BRITISH EVEREADY ELECTRIC CO. [Switches] 1,963/07; A. S. MOORE [Pendants with tilting shades] 2,197/08; W. GREEN [Lamp-holders] 2,106/09.

Telephony and Telegraphy: M. KOTYRA [Perforators] 2,542/06; J. SCHISSLER [Arc system of wireless telegraphy] 1,848/08.

Traction: E. F. W. ALEXANDERSON [Control of A.C. and D.C. motors] 1,773/08; R. A. DAWBARN [Trolley-wire suspension] 2,311/09.

Miscellaneous: F. W. CLARK and KELVIN & JAMES WHITE, LTD. [Magnetic compass] 2,351/02; M. WILLET [Electrical route indicator] 2,046/06.

The German Electrical Industry.—Our Copenhagen correspondent writes:—It is wrong to say that the industry in Germany is disorganised. In my opinion, it has never been so organised as at present, but the whole organisation has been altered to meet the war requirements. The Government has taken over practically the whole supply of brass and copper and other metals useful for war purposes. A vast number of factories are working day and night on Government orders, and, as the German Government pays tremendous prices, the firms, having this sort of work, do not care for any other. However, in the electrical industry there are a large number of small firms, especially down in the Thüringen neighbourhood. Most of these firms have no Government work, but they cannot supply the usual accessories because all their stock of metals have been taken from them. Therefore they now make lamp-holders, lamp sockets, switches, and, in fact, gradually all accessories, of brass-covered iron. With their usual technical thoroughness and cleverness they have succeeded in producing an article of first-class quality. The finished article looks exactly like brass, can be polished like brass, and, I believe, withstands moisture and other rough treatment. For a long time the Germans have been using insulated iron wires instead of copper wires.

ELECTRIC TRACTION NOTES

On p. 176 of our issue for April 22nd, we referred to a "late" Bill which had been introduced with the object of giving to the Underground Electric Railways of London and the London General Omnibus Co. statutory powers with regard to interchange of traffic and the pooling of funds. Reporting upon this Bill, the Parliamentary Committee of the London County Council expresses doubts as to whether the proposals are in the interests of the public. It is argued that under the conditions which it is now proposed to introduce, traffic routes could be abandoned in the financial interest of the companies to the detriment of the public, whereas at present, as each separate undertaking is on a self-supporting basis, this cannot be done. Objection is also taken to giving the London General Omnibus Co., which is not a Parliamentary concern, statutory rights similar to those to be conferred upon the railway companies. The Council is to oppose the Bill in Parliament.

On Friday a strike of the drivers and conductors on the London County Council tramways took place in consequence of the refusal of the Highways Committee to grant to all grades an increase of one shilling per day to meet the extra

cost of living. The trouble spread, and by Monday a good number of the men on the cars run outside London by the Metropolitan Electric Tramways, Ltd., joined the L.C.C. strikers. A few weeks ago the Highways Committee agreed to a war bonus of 3s. per week being granted for three months to employees earning less than 30s. per week, and later extended the period to November. So far as motormen and conductors are concerned, an agreement is in force, and expires on July 30th, and the Highways Committee contend that then is the right time to raise the question. On the other hand, the men say that the war conditions justify them in ignoring the agreement, and at the same time they make complaints of their conditions of work, which the shortness of staff, due to the war, has rendered inevitable. At the time of going to press all steps which have been taken to bring the strike to an end have been abortive, and the intervention of the Board of Trade has been ineffective.

At a meeting of the Croydon Corporation on Monday, the following resolutions passed at a Conference of the Managers of the Tramways Undertakings within the Metropolitan area on the 7th inst. were adopted:—“(1) That tramways revenue cannot be improved by increasing fares generally. (2) That joint action should be taken by the tramways authorities in the Metropolitan area to obtain more equitable treatment for tramways in respect of rates and the upkeep of the roads. (3) That powers should be obtained to jointly run omnibus services.” The Council is asked to approve these resolutions.

"ELECTRICAL ENGINEERING" TRADE SECTION

THE LIGHTING OF A MUSIC HALL

THE standard of illumination of places of amusement has been greatly raised of late, and a good example of a modern installation of this nature is found in the Finsbury Park Empire, of Moss's Empires, Ltd., the interior of which is illustrated here. The methods adopted form a great con-



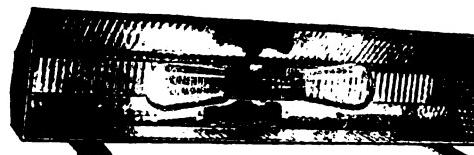
INTERIOR OF FINSBURY PARK EMPIRE.

trast both in artistic effect and sufficiency of lighting to the primitive arrangements of the earlier days of electric lighting. The hall is lighted throughout with Mazda drawn-wire lamps, and a beautiful effect is produced by the employment of the well-known "Veluria" white glass reflectors of the British Thomson-Houston Co., Ltd., Mazda House, 77 Upper Thames Street, E.C.

SHOP WINDOW REFLECTORS

SIMPLEX Conduits, Ltd. (Garrison Lane, Birmingham), have just produced a range of reflectors designed to illuminate the object displayed in shop-windows in the most economical manner. These reflectors throw all the light upon the goods—where it should be; none in the eyes of the observer. They prevent the pavement in front of the shop being flooded with light, thus meeting the requirements of scientific illumination, appealing to one's common sense and at the same time falling in with the new lighting

regulation. All the reflectors are designed for easy wiring and fixing, and at the same time are easily adjustable. A new leaflet has been issued describing this range fully, and



REFLECTOR FOR SHOP-WINDOW LIGHTING.

a copy will be sent on application to any of the Simplex Co.'s branches. One of the numerous patterns is illustrated here. This is arranged for screwing direct to the woodwork of the bottom or side of a window. It is lined with fluted mirror glass, and fitted with a special twin lampholder.

CATALOGUES, PAMPHLETS, &c., RECEIVED

SWITCHGEAR, &c., FOR WAR SERVICE.—Reyrolle & Co., Ltd. (Hebburn-on-Tyne), are making a special effort regarding the prompt supply of apparatus to firms engaged in the manufacture of war supplies, and carry large stocks of completed standard parts which can be built up into the desired forms of switchgear without delay, and are reserved for war service orders only. In this connection they are issuing a special series of leaflets describing their standard armoured draw-out pattern switchgear, in explosion-proof and other forms, low-tension ventilated self-aligning fuses, cast-iron distribution boxes, watertight plugs and sockets, earthed plugs and sockets, ironclad switches, oil break switches, &c. Our readers are familiar with many of these excellent designs, in which particular attention has been given to the Home Office recommendations as to safety, and the mechanical robustness which is essential to reliability.

CONDUITS AND FITTINGS.—Simplex Conduits, Ltd. (Garrison Lane, Birmingham), have just published a new edition of those sections of their catalogue dealing with conduits, conduit fittings, distribution boards, fuses, switchgear, watertight fittings, and cables. The list has been rearranged in a new form of very convenient size, and many new fittings and devices make their appearance. The whole arrangement of the list is such as to facilitate ready reference, and the well-thought-out methods of tabulation employed, which have always been a strong feature in the Simplex publications, greatly enhance its utility, and enables a very large amount of apparatus to be included within the limits of a compact volume.

W. H. ALLEN, SON & CO., LTD.

Queen's Engineering Works, BEDFORD.

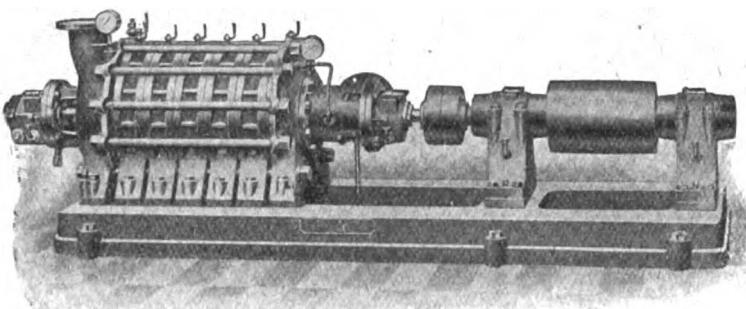
Telephone—No. 1, BEDFORD. And Queen Anne's Chambers, Westminster, S.W. *Telegraphic Address—“PUMP BEDFORD.”*

THE “CONQUEROR” PATENT TURBINE PUMP

CONSTANT
POWER,
CONSTANT
SPEED, WITH
VARYING
HEAD AND
QUANTITY.

SUITABLE
FOR
WORKING
AGAINST
ALL
HEADS.

— HIGH EFFICIENCY.—



CONQUEROR" HIGH-LIFT TURBINE PUMP, ARRANGED FOR BELT DRIVING. 265 GALLONS PER MINUTE. 610 FT. HEAD.

DRIVEN BY:—
STEAM
ENGINES.
STEAM
TURBINES.
WATER
TURBINES.
ELECTRIC
MOTORS.
BELT
OR
ROPE.



NO LOAD

PORTABLE ELECTRIC TOOLS

SEVERAL patterns of portable electric tools are described in a leaflet which has been issued by the Sun Electrical Co. (118-120 Charing Cross Road). One is an electric grinder with self-contained direct-coupled motor, which can be mounted on the slide-rest of a lathe. The whole apparatus weighs only 8½ lb., and the motor runs at 10,000 r.p.m., which gives the small diameter emery wheel the best surface speed. This grinder should be useful for a variety of work, and has a long "snout" so that it will grind out holes up to 4 in. deep. It is also suitable for a variety of external work, and should be a useful adjunct to any tool-room.

Fig. 1 shows a new design of portable drill of particularly

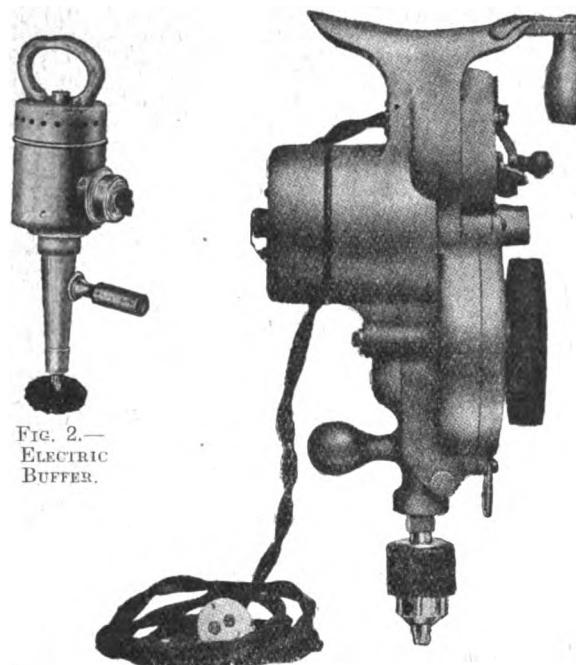


FIG. 1.—ELECTRIC DRILL.

convenient form to handle. The switch is placed close to the upper handle, and starts, stops, or reverses the motor with one lever. A special feature is that in which an emery wheel can be attached to the gear shaft, so that drills, &c., can be ground on the machine itself. Another ingenious detail is a device by which the drill spindle can be thrown out of gear by swinging out the bearing carrying it, and locked for tightening up the drill chuck. This tool weighs 11 lb., and can be used for drilling up to 3/8 in. and tapping up to 3/16 in.

Another useful tool for buffing and also grinding work, too large to be taken to ordinary machines, is shown in Fig. 2. This has extensive application in motor-car work, such as for buffing brass work. The motors driving all these tools can be run from either D.C. or A.C. circuits.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Barnsley.—The Corporation has approved of a scheme for extending the plant at the power station at an estimated cost of £21,850. During the course of a discussion on the scheme, it was stated that Mr. E. A. Barker, the Borough Electrical Engineer, is with the Army in France.

Bristol.—The Corporation has sanctioned an expenditure of £26,949 upon a new 6,000-kw. turbo-alternator, with the usual accessories, for the Avonbank power-house. At present there is only about 1,000 kw. of spare plant, which is not considered sufficient. With the new set, and taking into account all the new connections contracted for, the spare will be 3,514 kw., or practically the capacity of one of the larger generating sets.

Carnarvon.—The Council, having applied for a loan of £500 for mains extensions, has been asked by the Local Govern-

ment Board to postpone the matter until after the war. As, however, the mains are principally in connection with the tuberculosis hospital, it is felt that permission should be granted, and a note to this effect has been sent to the Board.

East Sussex.—The East Sussex Rural District Council has decided to instal a small additional generating set to the plant at the asylum. This is regarded as more economical than renewing the whole of the existing battery. An expenditure of £900 has been authorised.

Leigh.—The Corporation has received an intimation from the Local Government Board that the application for borrowing powers for extensions to the plant at the power station has been approved without holding the usual local inquiry. This is the result of action by the Corporation following on the receipt of a letter from the Director of Navy Contracts, asking for an explanation of a complaint made by the Anchor Cable Co. that delay in completing Navy contracts was due to difficulty in getting supplies of electricity.

Wigan.—An expenditure of £1,200 is to be incurred for transformers, switchgear, and cable for supply to the Pember-ton Colliery Co.

Wiring

London: L.C.C.: Hackney.—345 wiring points, S. Hackney County School. June 4th. (See an advertisement on another page.)

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bootle.—New school.

Bristol.—Labour Exchange, Colston Avenue. H.M. Office of Works, London.

Chadderton.—Smallpox hospital (£11,000). Lancs. County Council.

Rochdale.—Sanatorium (£18,900).

Miscellaneous

Manchester.—Twelve months' supply of electrical accessories, including lamps, wire insulators, &c. Secretary, Electricity Department. May 26th.

North Staffs Railway Co.—Twelve months' supply of electric lamps and fittings. Secretary, Stoke-on-Trent. May 22nd.

South Indian Railway Co.—Tenders are invited for electric lamps. Managing Director, 91 York Street, Westminster, S.W. May 26th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Aldershot.—The tender of C. A. Parsons & Co. for a turbo-alternator at £4,793 has been accepted.

Dover.—The Corporation has decided to introduce electrically-driven vehicles for dealing with the whole of the scavenging of the town. Edison Accumulators, Ltd., are to have the contract, and a considerable annual saving over the present arrangements by which horses are used is contemplated. Edison Accumulators, Ltd., guarantee the batteries to maintain their rated capacity after running 60,000 miles.

Edinburgh.—The tender of the Stirling Boiler Co. for water-tube boilers amounting to £92,000 is recommended for acceptance by the Electricity Committee.

Iford.—A contract has been placed with Edison Accumulators, Ltd., for a 4-ton electrically-driven wagon.

Pontypridd.—A contract has been placed with Siemens Bros. Dynamo Works for a twelve months' supply of Tantalum lamps.

Winchester.—An order has been placed with C. A. Parsons & Co. for a 500-kw. turbo-generator set at £3,991. A considerable reduction in working costs is anticipated from the use of this set. With the present plant 10,000 lb. of steam generates 400 units, whereas with the new plant the number of units generated with the same quantity of steam will be 530.

Messrs. Venner & Co. have received contracts for twelve months' supply of Chamberlain & Hookham meters from the Dundee and Swansea Corporations and the Battersea Borough Council. The Southwark Council has placed a similar contract for prepayment meters.

APPOINTMENTS AND PERSONAL NOTES

Sir Edgar Speyer, Bart., Chairman of the Underground Electric Railways of London, having resigned his seat on the Board, Lord George Hamilton, Deputy Chairman, has been appointed to succeed him.

Mr. J. Scrivener has resigned his position of Director and Manager of Krupka & Jacoby, Ltd., and has been appointed to control the sales organisation of the "Z" Electric Lamp Co., Ltd. Before leaving, Mr. Scrivener was presented by his co-directors with a gold watch, and by the staff with a suit-case.

Mr. Percy Taylor, Assistant Borough Electrical Engineer, Darwen, has joined the motor transport service.

A shift engineer is required at Ayr for the period of the war. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £87 10s. to £88 10s. (last week, £88 to £89).

Agencies.—The Peninsula Engineering Co., Ltd. (Suffolk House, Laurence Pountney Hill, E.C.), have been appointed sole agents for Luis Berenguer & Co., Ltd., Barcelona, makers of porcelains for electrical purposes.—A firm in Odense (Denmark) desires to represent British manufacturers of transformers, high-tension insulators, insulating materials, watertight fittings, tumbler and ironclad switches, ammeters, and voltmeters. Further particulars at 73 Basinghall Street, E.C.

Change of Address.—The Glasgow office of Messrs. George Ellison is now 227 St. Vincent Street, instead of Caledonian Chambers, Union Street.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Callender's Cable & Construction Co.—The net profit for 1914 was £98,692, against £91,862 for the previous twelve months. A dividend of 15s. per share on the ordinary shares (including a 5s. bonus) is recommended, as in 1913. The amount carried forward is £163,169. During the year the company received important contracts in connection with the British telephone system.

Electric Construction Co.—The net profit for the year to March 31st, 1915, after providing £6,800 debenture interest and £5,000 depreciation, is £35,567. A dividend of 6 per cent. for the year on the ordinary shares is recommended, carrying forward £7,471, after transferring £17,402 to general reserve. The directors report a good general demand for electrical machinery, which has been enhanced by special orders arising out of the war.

South Wales Electrical Power Distribution Co.—The Treasury has sanctioned an issue of £80,000 prior lien debenture stock.

LOCAL NOTES

Batley: *Extensions Held Up.*—Owing to the impossibility of obtaining the necessary loan, the Corporation has abandoned, for the time being, the laying of cables to certain districts where a considerable demand for current has arisen.

Blackburn: *Decreased Revenue.*—The Borough Electrical Engineer, in his annual report for the year to March 25th, 1915, states that whereas during the first few months of the year there was noteworthy and exceptional progress, after the outbreak of war there was a serious setback, and the

weekly output for all purposes has since shown a consistent decrease on last year's figures—a condition of affairs which he fears will continue. Further progress on the new power station has been deferred by the refusal of the Treasury to sanction loans for purposes not directly required for the war. Having regard to the increase in price of all materials, particularly coal, Mr. Wheelwright states that early consideration may have to be given to the question of increasing the revenue. The net profit for the year was £2,348, against £4,687 in the previous twelve months. Thirty per cent. of the men in the department eligible for service have joined the colours, and the further enlistment of men responsible for the maintenance of supply is deprecated.

Bradford: *Profits and Rate Aid.*—The Chairman of the Finance Committee, in his annual budget statement last week, said that the approximate profit of the electricity undertaking for the year 1914-15 was £12,000, of which £7,000 had been spent upon plant. The balance of £5,000 made the available total credit of the department £22,500, and from this he proposed to appropriate £7,500, as compared with £5,000 in the previous year. The profit of £12,000 is about £2,500 less than in 1913-14, but in view of the general conditions the result is considered satisfactory.

Carnarvon: *Suspension of Sinking Fund.*—The National Electric Construction Co., which guarantees the capital charges on the money borrowed for the Council's electricity undertaking, has suggested that an application should be made to the Local Government Board for a suspension of the sinking fund during the war. The Council, however, does not agree with this, on the ground that so far the Carnarvon undertaking has not suffered owing to the war.

Hertfordshire: *Electric Power Supply.*—The County Council has informed the London County Council that it will oppose any electric power supply scheme promoted by the latter which includes any part of the County of Hertford, and which interferes in any way with the purchasing rights of any local authority in that area.

London: *Islington: War Badges.*—Mr. G. A. Touche, M.P. for North Islington, recently asked in the House of Commons as to the desirability of issuing war badges for employees in electrical stations. According to the *Islington Gazette*, Mr. Touche moved in the matter at the suggestion of Mr. Albert Gay, the Borough Electrical Engineer.

Stafford: *Electricity Profits.*—The revenue of the electricity undertaking last year was £7,193, or £814 over that of the previous twelve months. The expenditure decreased by £372, and after placing £1,000 to depreciation, a balance of £342 remains.

Stalybridge, &c.: *Joint Board Dissension.*—An interesting point relating to the rights of the constituent members of the Stalybridge, Mossley, Hyde, and Dukinfield Joint Electricity and Tramways Board came before the House of Lords Committee last week. By the Act which constituted the Board, the whole control of the electricity and tramway undertakings in these four towns was passed over to the Board. This session the Board decided to promote a Bill for powers to supply electricity outside the area of the four towns. To this proposal some of the Dukinfield representatives on the Board objected, and the Dukinfield Corporation presented a petition against the Bill. The Committee decided, however, that in effect the Dukinfield Corporation was a promoter of the Bill under the terms of the Act which incorporated the Joint Board, and could not, therefore, oppose the Bill. A *locus standi* was consequently refused.

Swansea: *Street Lighting Scheme.*—A scheme of street lighting, estimated to cost £1,500, has had to be deferred owing to the impossibility of obtaining a loan, and to the fact that the reserve fund is not considered sufficient to deal with the scheme.

Water-softening Plant.—The new Regent Palace Hotel is equipped with water-softening plant for the hot and cold water supply to the bedrooms, as well as for the kitchens, boiler-house, and heating system, carried out by Messrs. Lassen and Hjort.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, MAY 27, 1915.

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SUMMARY

PROGRESS has been made with the formation of the Engineering Institutions Volunteer Training Corps. A meeting of those joining was addressed by Sir John Snell and Lieut.-Col. Clay at the Institution of Electrical Engineers last Thursday (p. 224).

A BADGE will be issued to members of the Electrical Emergency Service on taking up their duties (p. 224).

LAST Thursday a deputation of representatives of electricity and gas works attended before the Coal Exports Control Committee (p. 224).

AN electric supply station with Diesel engine-driven plant has been recently inaugurated at Karachi, India. Overhead distribution is used exclusively, and special precautions are taken against sea spray and sand storms (p. 225).

A NEW system for motor control employing a "lock-out" contactor is described (p. 226).

SOME interesting points regarding the lighting of rifle ranges were raised at a discussion last week by the Illuminating Engineering Society (p. 227).

THE rubber-insulated iron wires and cables in Germany have already been prohibited there, as the stiffness of the wire breaks the reclaimed rubber insulation when handled. Either zinc wires insulated with reclaimed rubber, or iron wires insulated with paper and metal cased may be used (p. 227).

THE inherent regulation of alternators is discussed in our Questions and Answers columns (p. 228).

A SPECIFICATION for an arc lamp with tungsten electrodes in an inert gas was among those published by the Patent Office on Thursday. Other specifications dealt with cable joints, traction, protective gear, commutators, and electrochemistry. Three patents connected with electrodes for alkali manufacture, and one for electric fuses for explosives, expire this week after a full life of 14 years (p. 229).

THE Treasury is allowing the Manchester Corporation to proceed with the Barton power scheme; two 5,000 kw. turbo-alternators and condensing plant are required at Edinburgh; mains at Walsall and Burton; various electrical material in Australia; and electrical supplies by a South Wales colliery company (p. 230).

THERE was a profit of £8,406 on the Salford electricity undertaking last year, compared with £3,629 in the previous year.—Coal clauses are to be inserted in all bulk supply contracts in future at Walsall.—A £39,000 scheme of extensions has been completed at South Shields (p. 230).

Arrangements for the Week.—(To-day) Thursday, May 27th.—Institution of Electrical Engineers. Annual General Meeting, 8 p.m.

Friday, May 28th.—Physical Society of London, at King's College, London. The list of Papers to be read includes one on "High Permeability in Iron," by Prof. E. Wilson. 8 p.m.

London Power Supply.—A conference of the municipalities and electric supply companies involved in the power scheme of the London County Council was held in London on Tuesday, at the instance of the L.C.C. Mr. G. H. Hume, Chairman of the L.C.C. Highways Committee, presided. A resolution was passed to the effect that the L.C.C. should not deposit or in any way proceed with an Electricity Supply Bill without giving the Borough Councils an opportunity of discussing it first, and it was also decided that a Committee should be formed including company representatives. A previous resolution by the Hammersmith Borough Council with regard to a linking-up scheme was not passed.

Confiscation of Mexico Tramways Co.'s Undertaking.—The directors of the Mexico Tramways Co., in a circular to the shareholders, describe the serious position in which the Company's affairs in Mexico are. The Company is interested in the Mexican Light & Power, the Mexican Electric Light Co., and the Pachuca Light & Power Co. So far as the tramways are concerned, the authorities have now seized these, and after working them for a short while, eventually closed the system down, apparently owing to the bad state of repair into which the rolling stock was allowed to get. Communication with the Company's officials is practically cut off. The authorities, however, have not yet taken over the control of the Mexican Light & Power Co., the Mexican Electric Light Co., and the Pachuca Light & Power Co., but the employees have had to be given higher wages. Simultaneously with this the receipts are practically only on paper and, further, the rate of exchange has deteriorated so that the peso is now not more than 5d., as against the normal rate of 25d. In addition, the Government owes a considerable sum on account of public lighting, which the Company has not been able to collect. At the same time, the Company has been compelled to maintain the public lighting and has had to import carbons, &c., and to pay for them in gold.

ENGINEERING INSTITUTIONS VOLUNTEER TRAINING CORPS

AT the Institution of Electrical Engineers on Thursday, a meeting was held in connection with the proposal to form a Volunteer Training Corps from those members of the Institution who are precluded by age or other good reasons from joining the active forces. Sir John Snell (President) was in the Chair and with him were Lt.-Col. C. B. Clay (formerly of the 8th Lancs. Artillery Volunteers) and Mr. H. C. Gunton, who is Commandant of the Post Office Signal Corps and also Staff Officer to General Sir O'Moore Creagh (Military Adviser to the Central Association of Volunteer Training Corps).

SIR JOHN SNELL said that extremely good results had been received from the circular which had been sent out a short time ago; 212 replies had come in, and 88 men had signed the enrolment form, whilst 68 members were doubtful as to the attitude they would take up. Lt.-Col. C. B. Clay, who held the volunteer decoration and was at one time second in command of the 8th Battalion of the Lancs Artillery, had been selected by General Sir O'Moore Creagh as Commandant of the proposed volunteer corps. [Applause.] Commandant Gunton, who had been an officer in the Royal Engineers Territorials, had formed a Post Office Volunteer Signal Corps, which at present consisted of 500 members, and they would hear shortly that Commandant Gunton had been good enough to offer certain facilities to the battalion which it was now proposed to form. It was also hoped that other institutions would join in and make up a big engineering unit. So far as he himself was personally concerned, Sir John expressed his extreme regret that for the moment he could not join in the drills, as his time was so much taken up with Institution matters and matters of a Government nature, that it left him very little even of his Saturdays and Sundays. Later on efforts would be made to form similar bodies in connection with the local sections. Already the Birmingham Electrical Volunteer Corps had been formed, and was doing good work. Finally, he pointed out that whilst the Institution was in no way responsible for the unit about to be formed, he could give the assurance that the Council would give practical sympathy and assistance in the matter of obtaining any of the apparatus that might be required. Probably, as there were among those present representatives of many manufacturers, there would be no difficulty in getting this apparatus.

Before Sir John Snell left the meeting Col. Clay proposed, and it was carried unanimously, that Sir John Snell be asked to accept the position of Honorary Commandant of the Corps.

SIR JOHN SNELL expressed his great surprise at this honour, and said that it afforded him the greatest pleasure in accepting it; at the same time he hoped before long to be able actually to drill with the members.

COL. CLAY, addressing those present, said that General Sir O'Moore Creagh had expressed the opinion that engineering units were of the greatest possible importance to volunteer corps. It was proposed to carry out work in connection with searchlights, emergency work in power stations, signalling, the running of emergency lighting sets, and transport work. With regard to wireless, he thought that for the moment this would have to be put on one side, as even the Post Office Corps was prevented from doing this work. At present, wireless work was absolutely prohibited practically all over the country. Mr. Gunton had received a letter from the Adjutant of the Birmingham Electrical Volunteers Corps, who stated that this Corps had a membership of 400 with an average muster of 200, and this showed what ought to be possible in London. It was not proposed necessarily to restrict the Corps to members of the Institution, and 30 or 40 men who had been drilling together elsewhere for some time, and who were mostly engineers, had asked to be allowed to join. With regard to premises for drilling, Commandant Gunton had kindly offered the Inns of Court Hotel, and also suggested that the Corps might drill in Gray's Inn Square, where the Post Office Volunteers also drilled. Both Commandant Gunton and his Adjutant, Mr. G. F. Preston, had been good enough to offer all the facilities at their disposal, and to find instructors at the beginning. It was also possible that the Corps might be able to drill at the City of London School. Further, Lt.-Col. Le Rossignol, the officer in charge of the London Electrical Engineers Territorials, had offered the headquarters of that body at Regency Street, Westminster, whenever they were available. Some of the members of the Institution who proposed to join the new Corps were at present members of infantry corps, and had wished to retain their dual membership. Col. Clay was, however, afraid that this would not be possible, and that the principle of "one man one corps" must be maintained. It had also been suggested that parties from the new corps might be sent to train with the regulars or territorials at week-ends, but a bar to this was the absence of any oath for members of Volunteer Training Corps. Personally, he was in favour of

an oath being taken, not because he doubted the honour of any of the members, but merely in order to facilitate training with the regular forces. Without the oath, difficulties arose from allowing bodies of unworn men to train under martial law as was the case with the regulars or territorials. So far as finances were concerned, he suggested an entrance fee of 5s. and a subscription of 5s. per quarter. With regard to uniform, Commandant Gunton informed him that the Post Office Engineers had been able to obtain theirs at 25s. a man. Probably the Post Office had special facilities, and, if another 5s. were added to that cost, it would probably meet the case. As to the work which would be covered, it was proposed to have squad drill, company drill, and he hoped ultimately battalion drill, and a very wide choice of technical work had been given them by General Sir O'Moore Creagh. The Post Office Corps had taken over telegraph and telephone work, but there would be plenty to do for the Corps in the directions he had already indicated, and there would also be mining, trench work, wire entanglements, and so on. The members might also be detailed for use for such work as lighting camps, in connection with which he had heard of difficulties having arisen.

Mr. Gunton then added a few words, after which questions and suggestions were invited from those present, and Col. Clay intimated that he would endeavour to arrange for the first drill in about a fortnight's time.

Readers wishing to join the Corps should communicate with Lt.-Col. C. B. Clay, Marconi House, Strand, W.C.

THE ELECTRICAL EMERGENCY SERVICE

WE want every electrical engineer in London who will give at least either four hours a day of his spare time, or four hours on alternate nights, to become enrolled in the Electrical Emergency Service. This Service is to fill the gaps caused by men who are leaving, or have left, to join the Army and to make munitions of war.

We have many names on our register already, but not enough to meet the emergency demand which is certain to occur during the next few weeks in view of Lord Kitchener's appeal for 300,000 more men.

Moreover, it is the *good* men we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees, but who are willing now to defer their rest a little longer in view of the national emergency.

A badge is being issued to members of the Service on their taking up their duties.

Applications for enrolment, on the form on p. vii., should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

COAL SUPPLIES

ARISING out of the National Conference on Coal Supplies to Gas and Electricity Undertakings, a deputation attended before the Coal Exports Control Committee on Thursday last, and laid the views of the Conference before them. The deputation consisted of Sir Corbett Woodall, Past-President of the Institution of Gas Engineers and Governor of the Gas Light & Coke Co.; Sir John Snell, President of the Institution of Electrical Engineers; Alderman Phillips, Chairman of the Salford Corporation Gas Committee; Alderman Kay, Chairman of the Manchester Corporation Gas Committee; Mr. Frank Bailey, Chief Engineer of the City of London Electric Lighting Co., Ltd.; Dr. Charles Carpenter, Chairman of the South Metropolitan Gas Co.; Bailie Smith, Chairman of the Glasgow Corporation Electricity Committee; Mr. Regd. Neville, M.P., Chairman of the Brentford Gas Co.; Mr. Hanbury Thomas, Managing Director of the Sheffield Gas Co.; Mr. J. S. Highfield, Chief Engineer of the Metropolitan Electric Supply Co.; and Mr. D. Milne Watson, General Manager of the Gas Light & Coke Co.—It was stated in yesterday's Standard that a conference of Members of Parliament is to be convened to insist upon further Government action to secure reduction in price.

ELECTRIC SUPPLY AT KARACHI, INDIA

THE electric supply scheme which has recently been inaugurated at Karachi has several points of interest, and is a good example of progress which is being made with electrical enterprise in India. Karachi is a port handling a considerable volume of trade, a growing commercial centre, and is likely to rise in the future to the important position as the terminus of the railway route from Europe. At present a town of over 160,000 inhabitants, it has been until now without public electricity or gas supply. The inception of the scheme is due to the Hon. M. de P. Webb, of the firm of Forbes, Forbes, Campbell & Co., Ltd., who applied for the necessary licence under the Indian Electricity Act, and raising the capital entirely in India, formed the Karachi Electric Supply Corporation, seven out of the nine directors of which are Indian gentlemen. This Company, with the assistance of their consulting engineers, Messrs. Handcock & Dykes, carried the scheme into effect with great success. The contractors for the equipment were Messrs. Crompton & Co., who were connected with the scheme from an early stage. It may be remarked here that the particularly fair provisions of the Indian law, more especially as regards the definition of a fair market price at which the undertaking is purchasable by the municipality, greatly facilitated the inception of the scheme. At the start a contract was obtained for public

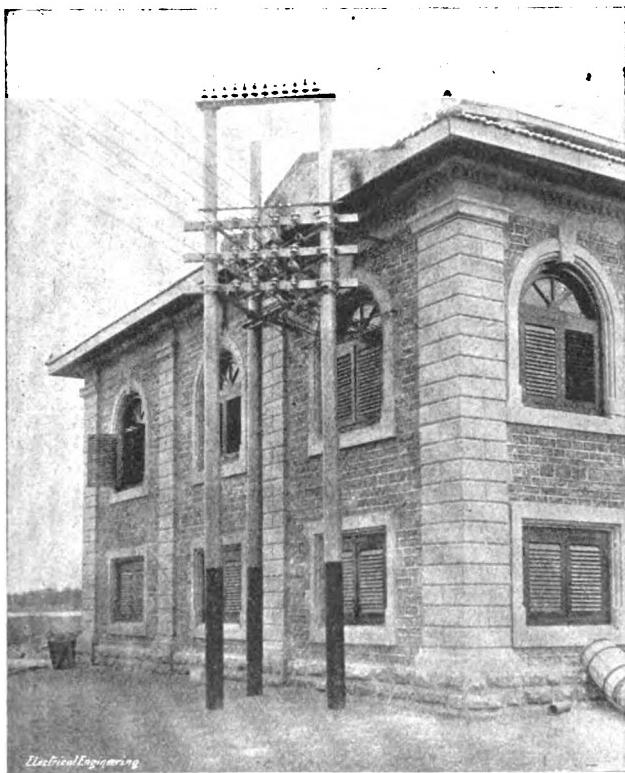


FIG. 1.—OUTGOING FEEDERS AT STATION.

lighting which had formerly been carried out mainly by Kitson oil lamps, and a considerable fan load was assured.

The site selected for the generating station is in Elander Road, close to the railway, and with ample space for extensions, and the general scheme is three-wire continuous-current supply from Diesel engine-driven plant, assisted by a battery. Although it is possible that future extensions, when the load is not only larger but more extended in area, may be carried out with alternating current, it was considered a sounder commercial proposition to employ continuous-current working during the initial stages.

The town is not only near the sea, but the subsoil is impregnated with sea-salt to an extent which rendered underground cables practically impossible, so that overhead distribution is used exclusively, but here again special precautions are rendered necessary by the climatic conditions. Karachi is not only by the sea and subject to winds from over the water charged with salt spray, but is on the edge of a desert, from which sand storms are liable to come when the wind is in the opposite direction. Erosion as well as corrosion is therefore liable to take place. For these reasons special protective measures, referred to hereafter, are taken with the overhead work, and particular care is taken to provide means

for completely closing up the engine-room on the approach of a sand storm. A considerable amount of difficulty was experienced with floods and uncertain soil in preparing the foundations, but a substantial bed of armoured concrete was

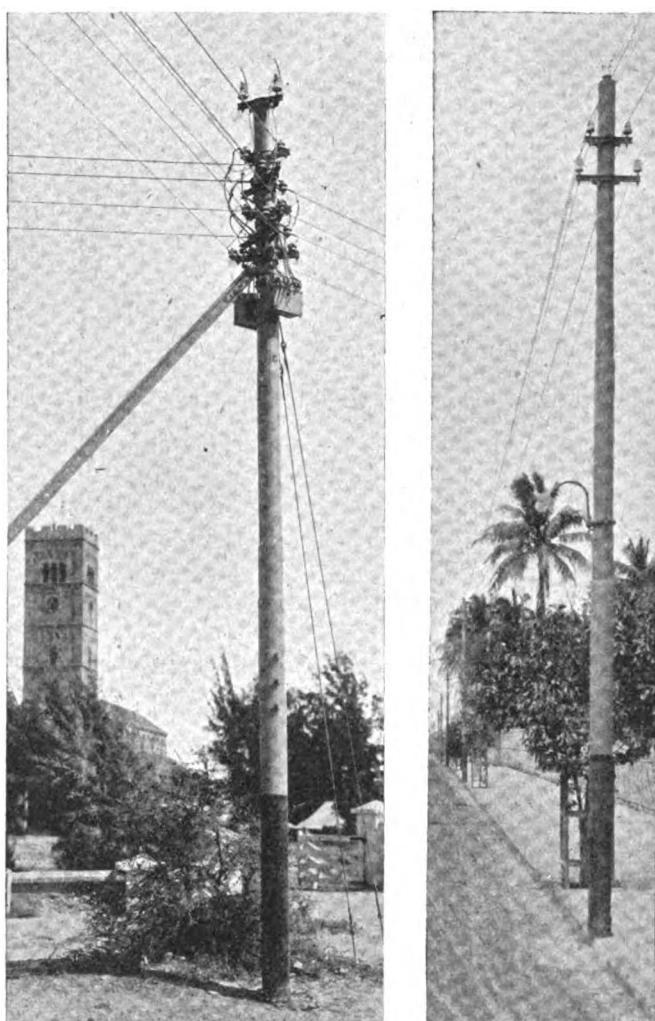


FIG. 2.—DETAILS OF OVERHEAD WORK.

eventually constructed to take the machinery. Some delay was also caused at the outbreak of the war by a portion of the staff being called off by Government work, and representatives both of the consulting engineers and contractors joining



FIG. 3.—TREATING BASES OF POLES.

the colours. The station, however, was ready for work in February of this year.

The main generating plant consists of two 240-b.h.p. and one 100-b.h.p. Diesel engines built by Mirrlees, Bickerton & Day, direct coupled to Crompton 440- and 580-volt dynamos.

The cooling water is dealt with by two coolers of Heenan & Froude's well-known rotary design, either of which alone can meet the full load conditions. These coolers are fixed in a separate cooler-house, and draw their air from the engine-room.

The main switchboard, consisting of three generator, two battery, two booster, two balancer, one summation, one earth, and three feeder panels of white marble, complete with moving-coil measuring instruments and switchgear, is mounted above the battery-room, being thus raised some 7 ft. above the engine-room floor. The battery consists of 276 Tudor cells, having a capacity of 653 ampere-hours at the 10-hours' rate. The voltage of supply is 220 on either side of a three-wire system, 440 volts across the outers, but at full load the station voltage will rise to about 512 volts, to compensate for the drop in the feeders. This necessitates battery regulating switches having a large number of contacts. These switches are of the horizontal pattern fixed in the floor above the battery-room behind the main switchboard, and are operated by levers similar to railway signal levers in front of the board. There are two automatic balancers, each capable of dealing with an out-of-balance current of 75 amperes, and three motor-driven boosters each capable of a continuous output of 150 amperes at 0-115 volts.

The whole of the overhead work has been carried out in strict accordance with the regulations of the Indian Government, and is most substantial throughout, with a considerable margin in the strength of the poles for additions as the undertaking develops. The weight of copper installed with the first section is 86 tons. In view of the climatic conditions already referred to, it has been considered advisable to protect the insulators by coating them with stoved bicycle enamel, and the whole of the copper, lines and all, is covered with special preservative paint. The steel poles are also covered with tarred hessian at the bases to protect against the corrosive action of the soil. Details of some of the overhead work are seen in the accompanying illustrations. The starting point of the outgoing feeders is seen in the view of the generating station in Fig. 1. In conclusion, we wish to express our thanks to Mr. H. W. Handcock, of the firm of Handcock & Dykes, consulting engineers to the scheme, for his courtesy in placing details and photographs relating to the undertaking at our disposal.

THE "LOCK-OUT" CONTACTOR SYSTEM OF MOTOR CONTROL

ATOMATIC motor control by contactor gear is coming into use very largely, not only for starting and stopping of motors driving pumps, compressors, &c., without an attendant, or where the scheme involves a number of complicated connections which must be rapidly made, as in the case of lifts and bridges, but also where the use of hand-operated apparatus for large motors becomes cumbersome and physically difficult in operation. Where it is necessary to have automatic acceleration, it is obtained by a solenoid controlled by a dash-pot, by counter E.M.F. control, or by current limit control. In this last, which has many advantages over the others, it has been usual to employ series relays, the dropping of which was governed by the motor current, which system results in the resistance being cut out just when the motor is ready for the change. The British Westinghouse Co. have recently put on the market a system known as "the series lock-out contactor system," which has all the advantages of these relays mentioned above, but in which is entirely eliminated the one weak point, the relay contacts. Its name is due to the special characteristic of the contactor used of "locking out" or not closing when the current is above a certain value. An automatic starter made up of a number of these contactors may have them so adjusted that they will only close with a pre-determined current on the motor. As long as the current is above the value at which the contactors have been adjusted to close, nothing will happen, a step of resistance being cut out only when the current has fallen down to the pre-determined value. The details of the contactor are seen in Figs. 1 and 2.

The motor current passes through the operating coil winding directly. With the contactor in the open position (shown in full lines), at the instant of applying current, assuming this

current to be above the value at which the contactor should close, a flux will pass through the main air-gap, through the armature, and along the steel piece A fixed to the armature and carrying the adjusting plug, then through the small air-gap between the adjusting plug, and on to the base. This flux tends to hold the contactor in the open position due to the pull between the adjusting plug and the base of frame being greater than the pull at the main air-gap. For a fraction of a second current is prevented from passing through the part marked "saturated section," due to the very heavy damping coil which is wound round this. The necessity for this will be explained later. As the current falls, due to the motor speeding up, the flux through A decreases, but the flux through the saturated section remains the same. In consequence, the pull between the adjusting plug and the base of the contactor decreases, until a point is reached where the pull through the main air-gap overcomes the pull at the adjusting plug, and the contactor closes. Adjustment of the air-gap between the plug and the base of the contactor alters the current value at which the contactor closes. Without the damping coil the contactor would close as the current was rising upon it, reaching the value at which it was set to operate. The damping coil sets up an entirely different condition in the magnetic circuit when the current rises very rapidly. Under these conditions the flux is prevented from passing through the portion marked "saturated section," and consequently it all passes through the adjusting plug. The increased "pull out" set up is so great that the contactor cannot close. In a fraction of a second after the current reaches the full value, the flux divides between the two circuits as previously described, and the contactor is held out by the normal operation of the lock-out device. It is free to close when the current falls to the value for which the contactor has been adjusted.

An ordinary non-reversing automatic starter embodying this type of contactor would contain, firstly, a shunt-wound contactor, the circuit of which would be made from some distant point, or from a switch operated by the rise and fall of water in the tank, or rise and fall of air-pressure in an air system, &c., as required. Secondly, a number of contactors of the type described above, which serve to short-circuit the resistance in the armature circuit. These contactors are so connected that without the use of any interlocking contacts each contactor is put into circuit, and consequently closes, in the order desired. Also the different contactors have their coils short-circuited, and consequently fall out as the next step of resistance to them is short-circuited, so that in the "full-on" position only the shunt-wound line contactor and the last series-wound contactor are in circuit. In order to keep the shunt coil as nearly as possible in line with the series coils as regards reliability, it is wound for a low voltage, and a resistance is connected permanently in series with it. The coils are impregnated with a special damp-proof compound

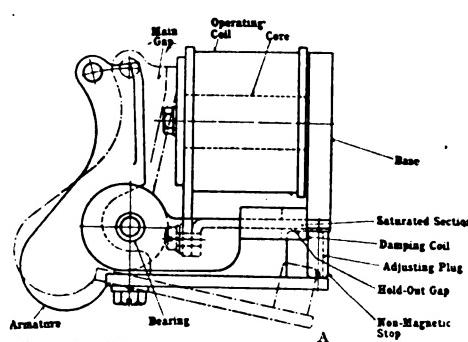


FIG. 1.—DETAILS OF LOCK-OUT CONTACTOR.

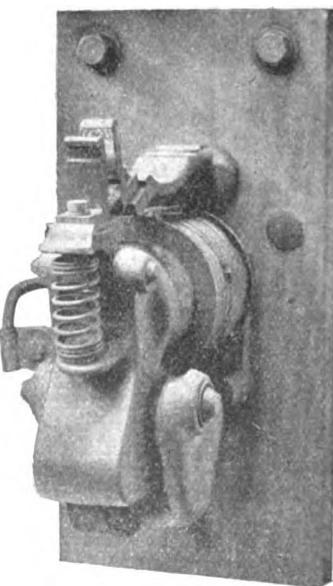


FIG. 2.—LOCK-OUT CONTACTOR.

which is capable of withstanding a high temperature without damage. The advantages over other automatic starter systems of simplicity in the reduction of the number of shunt coils

to a minimum and the absence of dash-pots and small interlock and other contacts will readily be appreciated. This apparatus was originally designed to meet the arduous conditions of rolling-mill work, where the adoption of automatic acceleration has very great advantages.

In addition, the elimination of the mechanical features connected with the earlier type of automatic gear, which has been possible by the adoption of the lock-out system, has quite fulfilled the requirements, and the extension of this type of apparatus to the ordinary applications of automatic starters and controllers will no doubt, due to the extreme simplicity and consequent reliability, overcome the distrust which exists in many quarters, and render its adoption more general.

THE LIGHTING OF RIFLE RANGES

A DISCUSSION on some points in connection with the lighting of rifle ranges was opened by Mr. A. P. Trotter at a meeting of the Illuminating Engineering Society on Tuesday of last week. Mr. Trotter described some of the difficulties which were experienced by those practising at rifle ranges, difficulties that were more strongly felt by elderly men with a liability to long sight, and were intensified when shooting by insufficient artificial light owing principally to enlargement of the pupil. Shooting at a daylight range was much easier, as the fore sight could be much more clearly seen. Opinions, however, differed as to whether the target solely should be illuminated. A target might be too brightly illuminated; in this case the disturbing effect was due to glare rather than apparent reduction of the diameter of the bull's-eye by irradiation. He did not think that dark backgrounds for small white targets were any great advantage. Sources of light should, of course, be screened from view, and with regard to lighting arrangements for facilitating observation of results, manipulation of targets, &c., it was desirable to aim at diffusion of light similar to that obtained out of doors. In conclusion, Mr. Trotter referred to some experiments which he had carried out in conjunction with Mr. H. Brazil on the rifle range of the Charing Cross, West End & City Electricity Supply Co. at Fenchurch Street. On this the marksmen fired through two screens 8 ft. by 5 ft., the first one of which was approximately 10 ft. away from the man. The apertures in these screens were of a size that an ordinary 6-in. target was just seen at the end of the range. These screens were each lighted by two 50-c.p. lamps, although Mr. Trotter thought that four would be better. He also thought that it would be better to have the walls of the range lighted as well as just the target and the screens. The general effect of the arrangement as it stands is a better definition of the top edge of the back sight.

Mr. A. Blok was of the opinion that in artificially lighting ranges the effect aimed at should be to direct light on to the target, and not to pay attention to the surround. Referring to the question of whether the target should have a black background or a light background, his opinion, from an examination of a large number of ranges, was that the most comfortable conditions were obtained when the targets were mounted on a brown background. With a surface brightness of about 10 ft. candles comfortable conditions were obtained if there were 5 ft. candles on the surround upon which the targets were mounted. A man's shooting could be very materially improved if he were provided with a target of less contrast than the usual black and white. It might be taken generally as bad to have exposed lights on the range, and a great deal could be effected by providing a good general illumination around the firing point. Similarly, he thought that keeping the firing point in absolute darkness was bad for the reason that it was extremely dangerous and uncomfortable. Furthermore, he believed that it conducted to optical fatigue. He had found from experiments with gradually increasing illumination from $2\frac{1}{2}$ ft. candles upward that an illumination of the target of about 12 ft. candles was the most comfortable for general work. At 50 ft. candles colour fringes made shooting difficult, and from 100 ft. candles upwards it was impossible to carry on the shooting notwithstanding that this illumination was very much less than was obtained with outdoor ranges and daylight.

Mr. Schamach thought that the only admissible form of illumination at the firing point was the completely indirect system.

Mr. H. Brazil said that he was interested in this matter as a secretary of a club owning three ranges and having 260 members. He first started with 50-c.p. lamps about 3 ft. from the targets on the floor inclined upwards. For some time they shot with these lights only. Difficulties, however, arose, partly due to the method of suspending the targets, the wires having a tendency to twist, so that eventually they tilted up and pointed at the light. To get a better illumination he put the lights above the target. That had a very good effect, as there was a good general illumination independently of whether the target was tilted or not. He agreed that the sources of light should be

screened from view, although it did not matter very much with the orthoptic sight if there was a good general illumination. As to Mr. Trotter's experiments at the Charing Cross range, the men could see the back-sight and fore-sight very much more clearly under these conditions than under the old conditions. He was inclined to think that the illumination from the firer to the target should be gradually diminished between the target and the firing point, and also, if possible, that the illumination on the bull should be three or four times that on the sights around it in order to get the bull more clearly defined.

Col. Gaitshill Burr said that his general experience of miniature ranges in London was that they were not sufficiently well lighted, and Mr. Freak suggested that a light background might have the same effect as the screens at the Charing Cross range. Speaking of lighting at the firing point, Mr. W. J. Bassett said that the difficulty was that if a light was behind it was not in the right place, whilst if it was in front, or on the right or left, it caught the eye. Semi-indirect lighting all round was an improvement. The closest imitation of daylight he had seen at a miniature range was at the Royal Automobile Club. The background was green, and there was a row of incandescent lamps at the bottom with an arc lamp at the top, and a combination of the two produced a very bright light, but it was a very difficult range to fire on.

In a written communication, Mr. Frank Bailey said that the lighting of an indoor range was an easy matter to carry out, and it did not seem necessary to limit the illumination provided it was well diffused and there were no harsh lines or brilliant beams of light. A target with a black bull on a white ground was easier to hit than a white bull on a black ground. In using the orthoptic sight most shots preferred to have the firing point dark, but with open-sight it is essential to have light on the firing point in order to be able to see the sights of the rifle. If the range is dark, with the exception of the target, he had found that sources of light should be screened from view in order to prevent distracting rays from crossing the line of sight, and in illuminating the target it was better to place the course of light below the target, thus throwing the light upwards. Mr. J. G. Clarke said that with a target illumination of less than 4 ft.-candles men complained of eye-strain and expressed a preference for illumination from 8 to 20 ft.-candles. Mr. G. Herbert, referring to the ranges on the Embankment, said that the illumination was from 8 to 15 ft.-candles, and very even illumination was obtained by steel reflectors. The targets were 2 ft. 6 in. apart and 2 ft. 6 in. from the ground, and the reflectors were 2 ft. 6 in. from the face of the target to the centre of the filament of the lamp. These reflectors were on a movable frame, so that they could be adjusted according to whether a bull or a figure target was being fired at, the degree of illumination in the two cases being different. Other targets were illuminated in the same way, except that the reflectors were reversed and hung from the ceiling. Light was given at an angle of 45 degrees.

GERMAN ELECTRIC LIGHT CABLES

Zinc Cables Insulated with Reclaimed Rubber

A NOTICE has been issued in Germany that the iron wires and cables insulated with indiarubber which have been put on the market in that country are contrary to the new emergency standards and are no longer to be employed. Paper insulation under a metal covering is allowed with iron wires, but rubber-insulated wires must be of zinc, and for the rubber only reclaimed rubber may be employed. The reason given is that, owing to the mechanical weakness of the reclaimed rubber, it would be liable to break in handling if it were employed on stiff iron conductors. New standards have been issued for the zinc conductors which are to be used as a substitute for copper. The sizes of the zinc cables range from 1.5 sq. mm. (equivalent to about 17 S.W.G. zinc wire or 22 S.W.G. copper) to 150 sq. mm. (equivalent to about 37/13 S.W.G. zinc or between 19/15 and 19/16 S.W.G. copper), and the radial thickness of this inferior rubber is to be 1 mm. (0.039 in.) on the smallest size, increasing to 2 mm. (0.079 in.) on the largest size—that is to say, in the case of the bigger cables even less than the standard of the British Engineering Standards Committee for good rubber. Apparently seven-strand wire is to be used even for the smallest size, and 19- and 37-strand for the larger sizes.

Westinghouse Staff and Munitions of War.—A short time ago a movement was started by the engineering and other office staff of the British Westinghouse Electric & Mfg. Co., Ltd., to express in a practical form their patriotic feelings, and it was suggested by them to the management of the Company that they should undertake in their spare time some manual work on munitions of war. This offer was accepted by the management, and operations were commenced almost immediately. For the present each man will work a 5½ hours' shift one night per week, commencing at either 6.30 in the evening or 12 o'clock at night. We understand that approximately 300 staff men have already volunteered for work on this basis.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,444.

State briefly and concisely what switchgear is necessary for a balancer panel for a 3-wire supply system, and explain its connections and the function of each piece of apparatus.

(Replies must be received not later than first post, Thursday, June 3rd.)

ANSWERS TO No. 1,442.

A 12-pole single-phase alternator, the rotor of which has open slots and is wound like an ordinary D.C. wave armature, has an extremely bad regulation on low power factors ($\cos \phi = 0.3$ to 0.5).

Ratio of Pole arc to Pole pitch = 0.63. Air gap = 0.05".

Can the regulation be improved without re-winding the rotor? If not, should slots in rotor between the poles be left empty, so as to diminish the rotor demagnetising effect? Would tunnel slots in the rotor improve the regulation? With 121 slots in rotor, should tappings be taken from slots 1 and 11 or 1 and 61?—"Y.E.L."

The first award (10s.) is made to "W. H." for the following reply :—

The causes of bad regulation in alternators are principally: ohmic drop (on small machines only), armature reaction, and inductance. The first-named is inherent and cannot be altered, as it would usually be impossible to wind the armature with larger wire. Dealing with armature reaction, this produces bad regulation by distorting the field, and consequently weakening it when on unity power factor, and actually demagnetises the field on lagging power factors until at zero power factor (lagging) the whole strength of the armature reaction tends to demagnetise the field. Inductance of the windings is again inherent, and cannot be altered without changing the winding. It will be seen that in order to improve the regulation of the alternator in question it will only be possible to do so by reducing the effect of armature reaction. The first and most obvious method is to lengthen the air-gap either by boring out the frame after removing the poles, or by grinding down the pole-faces. This will, of course, reduce the demagnetising effect of the armature, and thus improve the regulation. The extent to which this can be done will be limited by the heating of the field windings, or by the capacity of the exciter, as with a longer air-gap more ampere turns will be required per pole to produce the same flux. Fitting amortisseur rings on the poles might also produce a slight improvement. This is all that can be done to improve the regulation without re-winding the armature. If the alternator is a large one, it may pay to install a Tirrill or other voltage regulator. Coming now to improving the regulation of the alternator by re-winding the armature, it will certainly improve the regulation of the machine to wind only in the slots under the poles—that is, approximately two-thirds of the slots will be filled. At the same time, this will not materially alter the voltage, as the coils in the slots between the poles do not generate E.M.F., but do increase the inductance of the armature, thus

adversely affecting the regulation. Fitting a new rotor with tunnel slots would probably improve the regulation, as the iron on the top of the slots would provide a path for the flux produced by the armature demagnetising ampere turns instead of this taking the normal path along the air-gap. Tunnel slots would, however, very considerably increase the inductance of the armature, and this would tend to make the regulation worse. As to which effect would predominate depends entirely on the design of the alternator. With reference to the correct spacing of the taps, it would appear to be an alternator with an ordinary D.C. winding having a circuit close on itself. The taps would therefore require to be 180° electrical apart, and this would be obtained by tapping Slot No. 1 and Slot No. 11. If by any chance the winding is required to be of the open type, the taps would be taken from adjacent slots.

The second award (5s.) is made to "E. H." who writes as follows :—

Before considering the methods by which the regulation of a single-phase alternator can be improved, it is necessary to understand what factors govern the variation of the terminal voltage with load. The fall in voltage consequent upon increase of load is due to three causes :—(1) The resistance of the armature winding; (2) the inductance of the winding; (3) the phase difference between the current and the voltage. The resistance can be diminished only by decreasing the number of turns and increasing the sectional area of the conductors. Both of these are inapplicable to the present case, since the first would give a smaller voltage, and the second would require larger slots. Further, the resistance drop is generally only a very small proportion of the total drop in volts. The inductance of the winding depends chiefly upon the number of turns, the flux density in the teeth, the size and shape of the slots, and the length of the air-gap. Since it is not intended to put in a new rotor, the first two factors have to remain unaltered. Had semi-enclosed slots been used, the inductance of the windings would have been greater; and would have been still greater with tunnel slots. A longer air-gap decreases the inductance, and so improves the regulation. When the rotor is hand-wound, i.e., wound by pulling the wires through the slots, it is customary to leave about a third of the slots empty, and thus decrease both the resistance and the inductance of the winding. With an ordinary D.C. wave winding, however, all the slots have to be filled. The greater the angle of lag of the armature current behind the voltage, the greater is the demagnetising effect of that current, and consequently the smaller is the E.M.F. induced. Now in a single-phase alternator the M.M.F. of the armature current is a pulsating one, and can therefore be resolved into two equal components of half the amplitude rotating in opposite directions at synchronous speed. The component rotating in the same direction as the poles is consequently stationary relative to the latter; whereas the second component has a relative speed of twice the synchronous value. The second component thus endeavours to produce a periodic variation in the main flux. This effect is damped down by the eddy currents induced in the solid parts of the magnetic circuit, and still more effectively by those induced in the "damper winding." Hence, as far as the field magnets are concerned, we are left with the one component, the amplitude of which is only half that of the pulsating M.M.F. Coming now more directly to the question, we find that the regulation can be improved by (1) increasing the air-gap, and (2) by fitting the pole-shoes with a damper winding. The extent by which the gap can be lengthened depends upon the possibility of obtaining sufficient voltage for excitation. If the temperature rise is then excessive, either a fan can be fitted to the rotor, or more turns can be added on the field, if space permits. The second is the more effective method, and apparently has not been tried on this particular machine. The amortisseurs may take the form either of the usual bars through the pole-shoes, or of thick copper sheets attached to the face of the pole. The latter would be the simpler, if the air-gap can be increased a little. As regard the tappings, these must be such that the number of conductors is divided equally—or nearly so—between the two parallel paths. If the tappings were taken from slots 1 and 61, and if there were two conductors per slot, there would be only six conductors forming one of the circuits, whilst the other would have 236 conductors. With such an arrangement, the terminal voltage would be very small. If the tappings are from slots 1 and 11, there are 120 and 122 conductors respectively in the two circuits. An equal division of the conductors in this case would require the tappings to be taken from opposite sides of the armature—an arrangement that would generally be inconvenient.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 20th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,323/14. **Arc Lamp.** E. A. GIMINGHAM. An arc lamp with tungsten or similar electrodes, enclosed in a bulb similar to that of an incandescent lamp containing nitrogen or other inert gas. The electrodes are horizontal and of small diameter, and the arc is struck by a simple thermo-mechanical device. (Three figures.)

8,842/14. **Cables.** W. F. PRICE and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. An excessive pressure is apt to be developed in cables with oil or other liquefiable insulation by bends in laying, and a pressure relieving joint is described in this specification. The joint-boxes have an intermediate partition with air-tight and insulating means of carrying the conductors through it. Each portion of the box is provided with means for exhausting air and introducing oil and a pressure-relieving air-chamber. (Two figures.)

10,531/14. **Traction.** B.T.-H. CO. (G.E. CO., U.S.A.) A system of traction motor control in which current from a single-phase line is supplied to polyphase motors through a special phase converter. (Five figures.)

10,775/14. **Telegraphy.** S. LYLE. A method of sending messages by persons unacquainted with the Morse code more rapidly than is possible by hand-sending, by means of a board with rows of suitably spaced contacts representing each letter, over which a contact pencil is rapidly drawn by hand. (Nine figures.)

10,822/14. **Protective Gear.** A. G. COLLIS and CROMPTON & CO., LTD. A protective system for A.C. circuits, in which superimposed currents actuate suitable timed relays at various points. These relays are rendered operative on the development of a fault by currents set up in the secondaries of transformers, and cause the tripping of switches isolating the faulty section. (One figure.)

11,107/14. **Synthetic Hydrocyanic Acid.** A. V. LIPINSKI. A method for the synthetic preparation of hydrocyanic acid by the circulating passage of a gas mixture consisting of hydrocarbons, hydrogen, and nitrogen through an expanded high-pressure arc. The reactive gas mixture is cooled and freed from hydrocyanic acid, and blown in directly behind the point of most intense heat of the reaction for the purpose of preventing the decomposition of the part of the mixture which has not undergone the reaction. (One figure.)

14,861/14. **Commutators.** A. H. MIDGELEY and C. A. VANDERVELL. A commutator in which the sides of the segments and of the insulating sheets are provided with overlapping notches which are filled with a plastic insulating compound which afterwards becomes hard. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS AND TRANSFORMERS: CROMPTON & CO. and PENSABENE [Dynamos] 11,399/14; YERGER [Motor control] 21,271/14.

IGNITION: MASON [Magneton] 22,149/14.

Storage Batteries: OLDHAM [Secondary batteries] 16,509/14; BLUEMEL and BLUEMEL BROS., LTD. [Battery boxes] 19,197/14.

SWITCHGEAR, FUSES AND FITTINGS: BENJAMIN [Lamp holders] 7,298/14; RAILING and GARRARD [Fuses] 14,159/14; DAY [Lamp holders] 16,363/14; BEUTTELL and A. W. BEUTTELL, LTD. [Illuminating devices] 17,033/14; LAMKIN [Switches] 17,396/14; EVERED & CO. and NICHOLAS [Self-supporting brackets] 20,476/14; LAWSON [Combined lamp and reflector] 23,555/14; MIDGELEY & VANDERVELL [Dash-board lamps] 2,242/15.

TELEPHONY AND TELEGRAPHY: JUDD, FRASER, WOOD, and EASTERN TELEGRAPH CO. [Telegraphy] 5,294/14.

MISCELLANEOUS: SOC. ANON. DES AUTOMOBILES & CYCLES PEUGEOT [Transport of searchlights] 11,083/14; TORCHIO [Reactance coils] 11,116/14; HULBERT [Bicycle flash lamp] 12,189/14; GOODFELLOW and NEW BRITISH EVER READY CO. [Portable battery lamps] 3,521/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

CABLES, INSULATING MATERIALS, &c.: SOC. CERAMICA, RICHARD GINONI [Insulators] 24,631/14.

TRACTION: GES. FÜR ELEKTRISCHE ZUGBELEUCHTUNG [Train lighting plant] 13,554/14.

MISCELLANEOUS: COMPAGNIE DE FIVES LILLE [Magnetic clutches, &c.] 3,910/15; COLLER [Generating set] 6,098/15; SIEMENS & HALSKA A.-G. [Fire alarms] 6,457/15.

The following Amended Specification can now be obtained:

TRACTION: BROLT, LTD. [Car lighting] 27,604/12.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:-

10,974, 10,975, and 10,976/01. P. M. JUSTICE (Castner Electrolytic Alkali Co., U.S.A.) The first two of these deal with details of construction of electrodes for electrolytic cells for the manufacture of alkalis by the Castner process, and the last is for a method of supporting oscillating cells used in this process.

11,242/01. **Electric Primers.** SIR W. G. ARMSTRONG, WHITWORTH & CO., LTD., and J. G. STUART. Insulation of conductors in an electric primer for gun-firing, constructed to prevent escape of gas.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS AND TRANSFORMERS: W. J. STILL [Homopolar generators] 2,411/08; E. TURNER [Homopolar generators] 2,959/09.

Electrochemistry and Electrometallurgy: P. GURUTI and R. POMPILI [Electrolytic apparatus for making oxygen and hydrogen] 2,820/02.

Incandescent Lamps: C. SCHWABE [Tubular lamps and fittings for footlights] 2,829/04.

TELEPHONY AND TELEGRAPHY: W. E. HEYS [Microphones] 2,713/03; J. D. WHITE [Printing telegraphs] 3,067/07.

MISCELLANEOUS: P. C. HEWITT [Mercury vapour rectifiers] 1,851/04; W. H. CHAPMAN [Neutralising static charges on paper and fabrics] 2,474/05; W. SCHRÖDER [Electric time alarms] 13,523/09.

CATALOGUES, PAMPHLETS, &c., RECEIVED

LAMPS.—A new leaflet from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), gives prices of the full range of "Atmos" (gas filled) drawn-wire Osram lamps made at the Hammersmith works. These include sizes consuming 100 to 500 watts for 50 to 60 volts, 150 to 1,500 watts for 100 to 130 volts, and 300 to 1,500 watts for 200 to 225 volts, and the consumption is approximately half a watt per candle-power.

ELECTRIC COOKING.—A useful cooking set called "El-Grilstovo," consisting of a 600-watt circular open type glowing heater, 7½ in. diameter, a pan and a grill deflector, and retailing at one guinea complete, is described in a leaflet from Drake & Gorham, Ltd. (1 Felix Street, Westminster Bridge Road, S.E.).

SIGNS.—A new form of illuminated sign with interchangeable lettering is described in a leaflet from the Sun Electrical Co., Ltd. (118 to 120 Charing Cross Road, W.C.). A number of different patterns of this sign are manufactured, and are supplied complete with outfits of from 100 to 300 letters, figures, spaces, &c. Some of the models are combined with a reflector, lighting the goods displayed at the same time as the announcement is made.

REFLECTORS FOR HALF-WATT LAMPS.—Another list from the Sun Electrical Co. gives particulars of a new range of "Sunlite" enamelled steel reflectors for half-watt lamps, comprising extensive, extra-extensive, intensive, and angle parabolic types for interior illumination. These reflectors, although only recently introduced, are already in use in a large number of engineering workshops, factories, and stores.

DUST BELLOWS.—A card from the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), gives particulars of a British-made model of wooden dust "belows" for blowing dust out of electrical machinery and other places, and on the other side calls attention to the Company's well-known "Freezor" fans. The card can be over-printed with contractors' names and addresses, and is suitable for sending out with correspondence.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.]

Australia.—The Victorian Railway Commissioners require a supply of voltmeters, ammeters, and wattmeters. July 14th.—The Deputy Postmaster-General, Hobart (Tasmania), requires 8 miles of paper-insulated lead-covered cable for telegraph and telephone purposes. June 21st.—The Sydney Corporation requires a supply of maximum-demand indicators. July 19th. Further particulars in each case at 78 Basinghall Street, E.C.

Burton.—A three-phase main is to be laid at an estimated cost of £70 to supply the new Belgian Engineering Co. which has started business in Burton.

Edinburgh.—The Electricity Committee requires two 5,000-kw. turbo-alternators and condensing plant. City Electrical Engineer. June 21st.

Manchester.—A L.G.B. inquiry was held last week concerning the borrowing of £543,000 for the equipment of the new power station at Barton. This matter has been the subject of correspondence between the Corporation and the Treasury, the general feeling in Manchester being that the new Barton station should not come within the category of schemes not required for war purposes. The demands upon the Manchester Electricity Department by firms engaged on Government contracts are very considerable. It is, therefore, satisfactory to know that the L.G.B. Inspector at the inquiry stated that he had been instructed to deal with the application at the earliest possible moment. Mr. S. L. Pearce, City Electrical Engineer, stated he would have to refuse any further supply unless he can proceed with the new power-house.

Walsall.—L.T. distributing mains are to be drawn into existing conduits at an estimated cost of £450.—The L.G.B. has sanctioned the borrowing of £16,700 out of £23,595 recently applied for.

Miscellaneous

Edmonton.—Tenders are invited for the maintenance of the inter-communication fire alarms at the various elementary schools. Education Architect, Town Hall.

South Wales.—The Penrhybwr Navigation Colliery Co. invites tenders for 3, 6, or 12 months' supplies of electrical fittings.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £86 10s. to £87 10s. (last week, £87 10s. to £88 10s.).

Change of Style.—The business of H. Weidmann (Rapperswil, Switzerland), manufacturer of insulating materials, has been formed into a company entitled "Fabrique de Cartons Presspan et de Matières Isolantes pour l'Électricité."

Advance in Prices.—A. P. Lundberg & Sons (477 to 489 Liverpool Road, N.) announce that on all orders received after Monday last the net amounts shown on invoices will be subject to an increase of 15 per cent. instead of 5 per cent. as hitherto.

Agency.—A firm of agents in Cape Town, a partner of which will shortly be in London, desires to secure the representation of United Kingdom manufacturers of high-class electrical fittings. Further particulars at 78 Basinghall Street, E.C.

W. T. Glover & Co.—In the Chancery Division last week, Mr. Justice Astbury granted an application to alter the Articles of Association to enable the Company to acquire and work lead, copper, and coal mines, and to make lead, copper, and other alloys. It was explained that this extension is for the purpose of the existing business. The Company intended, it was stated, to acquire coal mines for its

own purposes, either by itself or in combination with other companies, or to acquire shares in such companies.

Change of Address.—Messrs. Tyler & Freeman are removing from 20 New Bridge Street, E.C., to larger premises at 40 Chancery Lane, W.C. Telephone number, Holborn 6490; telegraphic address, Potential Holb. London.

The Dalston Publicity Department of Siemens Bros. Dynamo Works, Ltd., is being transferred as from to-day (Thursday) to 39 Upper Thames Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

Professor Sir J. J. Thomson, F.R.S., has been awarded the Albert Medal of the Royal Society of Arts for his researches in physics and chemistry.

Mr. Arthur Wright recently arrived in Boston to take up an appointment in an advisory capacity to the Edison Electric Illuminating Co.

Mr. J. F. Cameron, Borough Electrical Engineer at Northampton, has been appointed manager of the tramway system in that town. Mr. Cameron has been acting as manager *pro tem.* since the resignation of Mr. Gottschalk.

Mr. H. M. Taylor, Borough Electrical Engineer at Middlesbrough, has obtained a commission in the Royal Marines (Submarine Dept.). At the last meeting of the Electricity Committee Mr. Taylor stated that he proposed to retain the management of the works by "remote control."

LOCAL NOTES

Glasgow: *Municipal Showroom.*—The conditions for the exhibition and sale of electrical appliances at the Electricity Department showroom agreed with the electrical contractors have now been issued. They are in accordance with those given on p. 128 of our issue for March 28th.

Grays: *Loan Refused.*—The L.G.B. has refused to sanction a loan of £600, as it is intended for mains extensions for ordinary consumers.

London: Islington: Infirmary Lighting.—The lighting of the Highgate Infirmary, which has, from time to time, been the cause of much controversy, is again under consideration. The Guardians are at present undecided as to whether they shall continue to generate electricity for themselves or accept an offer from the Borough Council for a supply in bulk. The cost of putting the existing battery and plant into order is estimated at £700, whilst the necessary alterations to link up with the Council's mains is put at £500. The present cost of generation is 1½d. per unit, and the Islington Borough Council quotes an all-round price for power and lighting at 2d. per unit. The Chairman and Vice-Chairman of the Electric Lighting Committee are in favour of continuing the existing plant, but the matter has been referred to the Lighting Committee for further consideration. In consequence, the Chairman and Vice-Chairman have resigned from the Committee.

South Shields: *Plant Extensions.*—The scheme of extensions at the electricity works just completed has cost £39,000. These extensions include a 1,500-kw. 2,000-volt three-phase 50-period turbo-alternator running at 3,000 r.p.m. The boiler plant extensions include a new boiler-house, in which has been installed two B. & W. water-tube boilers each having a heat surface of 5,346 sq. ft., coal bunkers, and conveying plant.

Walsall: *Bulk Supply Agreements.*—The Borough Electrical Engineer has been instructed to insert in all future agreements for current in bulk a coal clause, by which the price per unit will rise or fall according to the price of coal.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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Rates for Small Prepaid and Official Advertisements, see p. vi.
Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

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Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

A NUMBER of matters were discussed at the annual general meeting of the Institution of Electrical Engineers last week. Emphasis was laid upon the need for strengthening the financial position of the Benevolent Fund, which was referred to as quite unworthy of the Institution. An effort is being made to secure a modification of the Treasury bars upon capital expenditure on public works. The number of members who have joined the Forces now amounts to 928. A suggestion was made that these members might be relieved of the necessity of paying their subscriptions during the war (p. 232).

A FACSIMILE of the badge issued to members of the Electrical Emergency Service on taking up their duties is given on p. 233.

WE regret to record that 2nd Lt. H. G. Byng, third son of the late Mr. Gustav Byng, has been killed in action (p. 233).

A PAPER on colliery lighting installations was read recently before a joint meeting of the National Association of Colliery Managers and the Association of Mining Electrical Engineers by Mr. C. S. Corlett (p. 234).

ELECTRIC power is used in connection with the recovery of alluvial tin in South Africa (p. 234).

SEVERAL patent specifications relating to Electricity in Mines have been published during the last month. Two deal with safety lamps, one with flame-tight motor protection, and another describes a relay for bell signalling in mines (p. 235).

A QUESTION relating to the reversal of single-phase motors is propounded in our Questions and Answers column (p. 236).

THE British staff of the Constantinople Telephone Co. has returned safe to England.—Other notes under Telephony and Telegraphy deal with the construction of loading coils and wireless call devices (p. 236).

AMONG the subjects of Specifications published at the Patent Office last Thursday were lampholders, travelling searchlights, constant voltage generators and fuses. Application has been made for the restoration of a lapsed patent relating to mounting of metal filaments (p. 237).

RECENT innovations in train control used in New York are referred to in our Electric Traction Notes (p. 237).

ARTICLES in our Trade Section deal with motor-car accessories, an electrical tide gauge, railway carriage lighting, and alternator field regulators (pp. 238-9).

TRANSFORMERS and mains (£4,000) are required at Stalybridge; a three-phase H.T. switchboard at Redditch, and generating plant at Northampton.—A loan of £25,000 has been sanctioned at Derby (p. 239).

THE financial control of the Glasgow Electricity Department is to be placed in the hands of the Engineer and Manager.—Meter-reading errors involving a sum of £1,000, have occurred at Stoke-on-Trent.—London municipal electrical undertakings are recommended not to increase prices except where imperative.—Satisfactory results are recorded for last year by the Electricity Departments at Bury, Hull, and Dundee (p. 240).

ISSUES of new capital are being made by the Cornwall Electric Power Co. and the South Metropolitan Electric Light & Power Co. (p. 240).

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

THE programme of the Business Meetings which are to be held in London on June 17th and 18th, in place of the usual Convention, has now been issued. These meetings will not be open to visitors, and the customary social functions will not be held.

On Thursday, June 17th, reports by Mr. A. S. Blackman (Sunderland) and T. Roles (Bradford), on behalf of the "Point Five" Association, will be read on "The Practical Result of the Point Five Tariff" in the morning, and a report by Mr. F. Ayton (Ipswich) on "The Use of Electric Vehicles in Municipal Service" in the afternoon, when there will be a parade and demonstration of electric vehicles.

Friday, June 18th, will be devoted to the annual general meeting for business purposes.

These meetings will be held at the Institution of Electrical Engineers, Victoria Embankment, W.C. The Council has decided that engineer members of the Association on active service may be represented by deputies.

Association of Mining Electrical Engineers.—A meeting of the Notts and Derbyshire branch will be held at University College, Nottingham, on Saturday, June 5th, at 3.30 p.m. The Paper on "Experiences with Electrical Plant," by A. Smellie, will be discussed.

THE ANNUAL MEETING OF THE INSTITUTION OF ELECTRICAL ENGINEERS

THE Annual Meeting of the Institution of Electrical Engineers was held on Thursday, May 27th, Sir John Snell, the President, in the chair. An abstract of the Council's Report was given on page 213 of our issue of May 20th.

THE PRESIDENT, in referring to the result of the nomination for officers and Council, said there seemed to be a tendency for the representation to gravitate towards the lighting and power section of the industry, rather than to the telegraphic and telephonic section. Although the Council was responsible for the nomination of members of Council, the general body of members had considerable powers under the new Articles of Association to make any nominations they pleased and to add to the Council's list of nominees. It was, of course, too late to make any alteration this year, but he hoped that another year there would be more nominations from members. The fact that only 551 ballot papers were returned out of a total of over 4,000 which were sent out, showed rather a lack of interest.

In presenting the annual report of the Council, the President commented upon a number of matters. The Institution, he said, was to be congratulated that in spite of the serious times through which the country was passing, it had been possible to keep the meetings fairly well alive. There had been a most admirable set of Papers, and thanks were due to the authors.

A great deal of work had been done by the Institution in connection with national service. Not only had the Institution placed offices at the service of the War Office, but Mr. W. Duddell, Mr. A. P. Trotter, General Ruck, Mr. Robert Hammond, and others were instrumental in recruiting the Engineer Unit of the Royal Naval Division. Such a good type of man was obtained that the War Office called upon him (Sir John Snell) to make selections for commissions in the Royal Garrison Artillery, and in a few instances in the Royal Engineers, and he was happy to say that, although this had involved a good deal of work in weeding out, not one of the recommendations of the Institution had been turned down. He was also glad to say that in a few instances the candidates had already received captain's rank or full lieutenancies. The number of members now engaged in naval or military service was 928, and seeing that the total number of the Institution was about 7,000, and also remembering how many members were engaged on other national work, this was a very fair percentage and spoke a great deal for the loyalty of the members of the Institution. An effort was now being made to raise a Volunteer Engineer Corps under Colonel Clay. (Full particulars of this were given on page 224 of our last issue.)

Referring to the paragraph in the report as to the enemy's trade, the President said he wished to emphasise that the Committee had come to the conclusion, *with the concurrence of the manufacturers' representatives*, that the Institution could not take any useful action in the matter. The Council, he said, had been criticised adversely during the last year or two for its so-called inability to appreciate any industrial necessities. In this case joint meetings were held between the representatives of the B.E.A.M.A. and the Institution, and, although many suggestions were made, it was the joint opinion that nothing could be done in the matter at present, and that the matters which had been under consideration would solve themselves to a large extent by the result of certain economic principles.

The Loans Committee had been at work under the chairmanship of Mr. Hammond, and the Council that day had passed a draft memorial to the Local Government Board, which might be followed by a deputation, and it was hoped that certain concessions would be given which would be helpful to municipal undertakings.

In this connection he also mentioned that, as President, he was associated with the Presidents of the Institutions of Civil and Mechanical Engineers in making representations to the Treasury and the L.G.B. on the regulations restricting capital expenditure on public works, and it was possible some good might be done in that respect.

Coming to the Benevolent Fund, Sir John Snell referred to his recent appeal to the members, and said that, whilst the Council desired to acknowledge its indebtedness to the generosity of the donors and subscribers who had supported the Fund, it was felt that the response was totally inadequate. The result of the appeal was thirty-five annual subscriptions amounting to £41, and thirty-eight donations amounting to £276. Criticism had been levelled against the Fund that the outgoings were so small that there was no real necessity to extend the income; but that, he could assure the members, was quite wrong. At the time of his circular there were three, but now there were two, very important cases in which, if anything like adequate support was to be given, a very substantial annual contribution must be made; but this could not be done with the Fund at present at their disposal, without, at any rate, endangering the chances of helping others who might come later. We did not, continued Sir John, know what was in front of us. There were 928 members serving in the Forces; a great number would never come back, and some of them would have dependents who would look to the Benevolent Fund of the Institution to help them,

and what could they say, as one of the greatest engineering institutions in the world, it, when appeals were made, as he was afraid they were bound to be made, they were not able to help properly the dependents of those who had laid down their lives in the service of the country. He hoped at the beginning of the new session, when either himself or his successor would address the members on this same subject, there would be a more generous response. It was not a question of two or three guineas at a time. A great many of them could not afford that, but they could all afford to give their mite, and even a few shillings per head from the members of the Institution would give such an assured income that they could do proper and useful benevolence amongst those members who had fallen by the way.

Discussion of the report was then invited, and several subjects were touched upon.

MR. LL. B. ATKINSON asked if there was any reason why there should not be published a full list of the members of the various Committees of the Institution, in order that the general body of the members might know who were doing so much good work behind the scenes. With regard to the constitution of the Council, there was a feeling in many quarters, in a general way, that, as the Council itself proposed the list of candidates for new membership, if any outsider suggested members it would be considered as something in the nature of a criticism of the Council. He hoped the remarks of the President would go a long way to remove that feeling. Finally, with regard to the Benevolent Fund, whilst admitting that he had been a great sinner in not having yet contributed, he could not help feeling that the matter had not really been brought before the members in the way it should. The present was, of course, a very difficult time for people to make subscriptions to such funds, owing to reduced incomes and the general uncertainty as to the future, but he believed that if the matter was dealt with in a proper way and not by sending out appeals, as was done on the last occasion, with a lot of other papers which did not get read, more satisfactory results would be obtained. He agreed with the President that the present state of the Benevolent Fund was quite unworthy of the institution.

PROF. J. T. MORRIS asked for further information as to the reduction in membership.

MR. S. EVERSHED agreed that there had been a feeling among the members that to put up competitive candidates with the nominees of the Council was generally regarded as a form of criticism of the Council. As one means of getting over this he suggested that, as old members of the Council knew best the qualities necessary for making a good member of Council, these should be invited each year by the Council to suggest names of suitable men. In this way a new flow of names would be available without in any way trenching upon the duty of the Council in putting forward its list.

MR. W. M. MORDEY also supported Sir John Snell's appeal with regard to the Benevolent Fund. It was a very sad state of things that, after all these years of work, there was only the accumulated sum of £4,642. During the past year the contributions, taken as an average per member, was less than 6d. An increase in the Fund was urgently wanted for the necessities of deserving people, and what was wanted more than anything else were small contributions, anything from a few shillings to ten shillings from all classes of members, including the students. Many members probably did not want to contribute unless they contributed gold, but the management would be only too pleased with an average of 2s. 6d. a year per member. This would put the Fund in the position it should be. Many cases, quite pitiable, came before the management, which could not be put before the members of the Institution, and it was regrettable that in present circumstances these cases could not be helped.

MR. W. R. RAWLINGS suggested that an appeal asking all members to promise an amount not exceeding 5s. would result in 90 per cent. of the membership responding.

MR. F. C. RAPHAEL heartily agreed with the previous comments concerning the Benevolent Fund, but urged that gold contributions should be also encouraged as much as possible in a different manner. He suggested the formation of a fairly large committee of influential men, who could write personal letters to their friends and generally make a personal effort in collecting contributions, instead of sending out printed forms. Some of the richer firms also might be approached through their chiefs, who were members of the Institution, to give much larger sums than the majority of donations and subscriptions amounted to. Referring to the large number of members who had responded to the calls of the Army, he suggested that the Council might possibly find a means of remitting the subscriptions of these members during the war. This had been done in almost every club in the United Kingdom, and, if it was within the power of the Institution to do it, he was sure it would be appreciated.

MR. W. HOME MORTON suggested that the difficulty with regard to subscriptions to the Benevolent Fund might be got over by the members agreeing to a small addition to their annual subscriptions.

THE PRESIDENT, in replying, said he personally would thoroughly welcome the publication of a list of committees and

the attendances, as suggested by Mr. Atkinson. This was done in connection with the Incorporated Municipal Electrical Association, and nothing in the government of that Association pleased the members better. He believed it would astonish the members of the Institution to know the excellent attendances which were made by the members of the Institution Committees, and the matter would be considered by the Council. Similarly, the suggestions made regarding the composition of the Council would be duly considered. Probably he had not been quite fair to himself in his previous remarks on the question, because there was a very wide representation, having regard to the fact that the chairmen of the Local Sections were members of the Council, and also that the immediate past-chairmen were *ex officio* members. Thus there was a very good geographical distribution; but what he was aiming at was a more catholic representation, so that the various sections within the industry were fully represented. As to reduction in membership this was partly due to the examinations, which, however, whilst keeping down the number of new entries into the Institution, resulted in a much better class of man joining. That was all to the good. Probably also a number had resigned owing to present times, and due regard would be given to the suggestion of Mr. Raphael that some consideration should be given to those who had joined the Forces. He was afraid, however, it would be a big question to remit the subscriptions to the whole 900 members who were concerned, as it would mean a very big slice out of the total income. The various suggestions with regard to the Benevolent Fund were most valuable and would be considered by the Council.

MR. ROBERT HAMMOND then presented the annual accounts, which showed an excess of income over expenditure of £1,623 10s. 8d., compared with £2,832 12s. 3d. in the preceding twelve months. It was not, however, he said, the right thing to compare these two figures, as in the immediate previous years the Institution had benefited by the increased income due to the rush of members to join before the higher subscriptions came into force.

A short discussion then followed, chiefly with regard to certain technical details of the manner in which the accounts were presented, and the accounts were then passed.

Votes of thanks to the Honorary Secretaries of the Local Sections, to the Honorary Treasurer, the Honorary Auditors, and the Honorary Solicitors were passed, the Honorary Auditors were re-elected, and the meeting then adjourned.

THE ELECTRICAL EMERGENCY SERVICE

WE want *every* electrical engineer in London who will give at least either four hours a day of his spare time, or four hours on alternate nights, to become enrolled in the Electrical Emergency Service.

This Service is filling the gaps caused by switchboard attendants in London electricity works and substations who are leaving, or have left, to join the Army and to make munitions of war. A badge, of which the annexed sketch is a facsimile, is issued to members of the Service on taking up their duties.

We have many names on our register already, but not enough to meet the emergency demand which is certain to occur during the next few weeks in view of Lord Kitchener's appeal for 300,000 more men.

Moreover, it is the *good* men we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees, but who are willing now to defer their rest a little longer in view of the national emergency.

Applications for enrolment, on the form on p. vii., should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

Engineering Institutions' Volunteer Training Corps.—Good progress has been made with the formation of this corps. Arrangements have now been made for drills three nights a week (Monday, Wednesday, and Friday) from 6.30 to 8.30 at the headquarters of the London Electrical Engineers Territorials, Regency Street, Westminster. The first drill was last night. Particulars with regard to the corps will be found in our last issue (p. 224), and readers wishing to join should communicate with Lieut.-Col. C. B. Clay, Marconi House, Strand, W.C.

OBITUARY

SECOND-LIEUT. HARRY BYNG, third son of the late Gustav Byng (founder and late Chairman of the General Electric Co., Ltd.), was killed in action on May 16th. His loss will be greatly regretted by

many friends, and the country has lost an able electrical engineer of the younger generation. We proffer our deepest sympathy to his two brothers and his colleagues.

HARRY GUSTAV BYNG was born on July 12th, 1889. He was educated at Harrow, where he was Captain of the School Gymnasium eight, and Monitor and Head of his House, for which he played both cricket and football; he also played for the Harrow Association Football XI. After leaving Harrow he joined Faraday House, and was

awarded the Silver Medal in his year. He then completed his education at Harvard University, where he passed all his examinations with honours, and enjoyed extraordinary popularity, both socially and as a good sportsman. He was Captain of the Harvard Association Football XI. When leaving Harvard he joined an exploring expedition into the lesser-known parts of Canada, and, after a short return home, joined the General Electric Co., Schenectady, as a pupil. He distinguished himself in the test room, and was on the fair road to success, when his duty towards his family called him back in order to assume a position in the General Electric Co., Ltd. He settled in Warwickshire so as to live near the works at Witton, and was on the point of assuming a position of responsibility when war broke out. His sense of duty to his country made him join his Majesty's forces during the first week. He trained with the Artists Rifles and went to France with them at the end of September, returning home on March 21st on five days' leave, during which time he married Miss Evelyn Curtis, of Boston and Beverly Farms, Mass., U.S.A. Immediately after he was gazetted 2nd Lieutenant of the Second Border Regiment, and fell in battle on May 16th near Festubert, in France, whilst leading his platoon. His commanding officer wrote: "Mr. Byng was wounded whilst most gallantly leading his platoon in action on May 16th. He was universally popular in the regiment. He had done very good work reconnoitring the enemy's trenches, and his loss is very great to the battalion." A letter from the adjutant of his regiment also pays tribute to Mr. Byng's courage and self-denial. It says: "He was shot whilst leading his men, and fell actually on the enemy's trenches. He lay quite uncomplainingly and would not allow any of his men to carry him back because of the danger to their lives."

Institution of Railway Signal Engineers.—The next meeting will be held at the Institution of Electrical Engineers, Victoria Embankment, E.C., when Mr. Bound will reply to the discussion on his paper, "A Review of the Art of Signalling and some Suggestions."

Institution of Electrical Engineers.—The following is the result of the ballot for new members, &c., at the annual general meeting on Thursday:—**Associate Members.**—J. H. Buchanan, J. B. Bullock, A. Boyd. **Associate.**—E. G. Byng. **Graduates.**—E. Greenhalgh, A. J. Hainsworth, C. S. Hickie, A. A. Ahmed, E. J. Black, E. S. Bolton, F. L. Cater, E. E. Walker. **Students.**—D. K. Bhavé, K. Coombs, F. Frost, E. A. Hounsell, S. A. Kidvai, A. H. Leeves, J. C. Prescott, L. M. Barlow, B. Dennis, F. Malone, S. R. Mellonie, F. D. Moul, C. R. Taylor, H. V. Young.

CANDIDATES TRANSFERRED: *Associate Member to Member.*—L. H. Combe, J. W. Saaler, J. F. Crowley. *Associate to Member.*—J. W. Punter. *Student to Associate Member.*—A. C. Fendick, F. T. Gerstenberg, R. E. Dickinson, N. F. Hecht, C. E. Robertson, R. H. Vaudrey. *Student to Graduate.*—S. K. Chatterjee, C. G. Saltren-Willett, C. A. Smiles, G. D. Aspland, E. A. Elliman, H. J. Henwood, S. R. Sahgal.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

■ COLLIERY LIGHTING

A PAPER on colliery electric lighting, by Mr. C. S. Corlett, was read recently at a joint meeting of the North Staffordshire Branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers. The author described some early experiences with underground and surface lighting as far back as 1888, and went on to refer to the Home Office Rules with regard to underground lighting. While there might be differences of opinion, he said, on points of detail, the main principles were such as to ensure good and reliable work. The Home Office Factory Rules should be followed for surface work. The essentials of a properly-arranged distribution system were : That feeder cables should be run from a main switchboard or main control board to suitable double-pole distributing fuse-boxes; that no lamps should be connected to the feeder circuits; and that branch circuits for not more than 10 points should be run from the distribution boxes to the lamps. In the author's opinion, the best method of protecting the internal wiring at a colliery was by means of well-arranged screwed piping, and for particularly exposed or damp situations, galvanised piping. Open wiring supported on cleat or other types of insulators had given reasonably satisfactory results, yet the absence of mechanical protection to the wires was a serious objection. A frequent example of bad workmanship was the indiscriminate bunching of wires at the back of switchboards, or in the vicinity of distributing centres. Plain pendant fittings were unsuited to dusty situations; it was better to use totally enclosed dustproof fittings. Where there was much vibration, short lengths of metallic flexible tubing would prevent damage to the lamps.

Although the standard of maintenance was improving, the following practices were often observed :—The use of fuse wire of incorrect size; not keeping the box-covers properly screwed down so as to exclude dust; and omission to replace broken outer globes. The author considered that better results would be obtained by improving the status of the colliery electrician, whose remuneration was often quite inadequate, and by giving him actual instead of nominal charge of his department.

The carbon lamp might be said now to have had its day, and for present requirements only the metal filament lamp need be considered. In the smaller sizes, those for 100/110 volts were more satisfactory than those for 220/250 volts. The former was the most suitable pressure for colliery work, and could easily be provided on A.C. systems by transformers. In D.C. systems the problem was not so easy. It was not always economical to have separate plant for lighting, but a suitable lighting voltage could often be obtained by the use of a balancer. The arrangement of lamps in series on the power mains was not good practice. The use of 110 volts for lighting had the advantage that the rule as to earthing did not apply at this pressure. Self-contained lighting transformers, complete with switches and fuses in one cast-iron case with several compartments, could be conveniently used fixed alongside the ironclad power-control switches in the sub-stations and connected to the bus-bars through a few inches of piping. Rule 129 (c) stated that all conductors must be of the concentric type or provided with a metal covering, excepting only such portions of the low-tension system as are not fixed on roadways used for mechanical haulage, and where no danger exists for firing gas or other inflammable materials. The author further remarked that it is seldom desirable to limit the lighting system so that no portion of it will be on a haulage road—as excepting for loading into the cages it is probable that at the terminals of the haulages the greatest advantage of electric lighting accrues. It was, he said, undesirable to have a mixed system, that is to say, protected wires on one roadway, unprotected wiring on the next. It may therefore be concluded that, excepting concentric wiring, practically all colliery underground lighting must be protected with a metallic covering enclosing the whole of the conductors in the circuit. Speak-

ing broadly, the choice of this protection is limited to two types—steel tubing and armouring of the cables. Excepting on masonry or on the steel-girdered roofs of motor-houses the use of tubing is inadvisable.

The author has used twin-armoured conductors with satisfactory results. The conductors consist of circular twin V.I.R. cables, armoured and braided overall, and are carried on the usual form of suspender in convenient positions along the roadways, generally at the side, and as close to the roof as possible. At each lamp the branch distributor cable is cut and a circular galvanised-iron box is fitted, provided with suitable cover and suitable insulated connectors inside. In many cases an ordinary 3-way conduit box has been used. The insulated conductors are brought inside through a suitable gland, the armouring being terminated on the outside by a suitable armour clamp; the third or tee opening is provided with a short length of tubing, the other end of which is screwed into the lamp fitting. In cases where rigid tubing may be undesirable or difficult, short lengths of flexible tubing can be employed. At the last lamp on the circuit the blank outlet can be fitted with a plug, and at points where more than one lamp is required 4-way instead of 3-way boxes can be furnished. Only a small amount of concentric wiring has been carried out in collieries.

ELECTRIC POWER IN A SOUTH AFRICAN TIN MINE

A PAPER by Mr. W. Elsdon-Dew, published in the Transactions of the South African Institute of Electrical Engineers, describes the application of electrical power to the operations of Swaziland Tin, Ltd., M'Babane. The tin recovered is all alluvial, and occurs over a very wide area at points at considerable distances apart. Water power from one of the numerous streams from the eastern slopes of the Drakensberg range of mountains is utilised by a 300-h.p. Pelton wheel running under an effective head of 500 ft. at 500 r.p.m., and driving a 250-k.v.a. 550-volt 50-cycle three-phase alternator with a direct-coupled exciter. Power from this plant is transformed up by a single transformer to 3,300 volts and transmitted in different directions, the greatest distance being about 3½ miles, by overhead wires. Power is used for driving centrifugal gravel pumps and high-pressure nozzle pumps for sluicing down gravel. The exciter has a capacity in excess of the excitation requirements, and is used for station lighting and auxiliary services. The transmission line is of aluminium 7/0'114 sq. in., and in the particular circumstances a saving of 22 per cent. was made over the cost of an equivalent copper line, although the cost of supports and handling the aluminium was higher than it would have been for copper. The lines extend to three districts, named "Grey's Creek," "M'Babane Flats," and "King's Flats," where the workings for alluvial tin require motive power in some form or other. The tin is obtained out of the river wash in the following manner :—

The tin is finely divided in particles, varying from ¼-in. cubes down to very fine particles, and, being heavy, settles in the bottom of this stream, provided the method of handling allows for this. The usual method of washing down the river deposit and passing it through boxes containing riffles, &c., is adopted, but unless there is a considerable fall in the river-bed the débris soon chokes operations. Power is therefore used for raising the gravel out of the river-bed by means of gravel pumps to suitable places where the fall from the sluice-boxes is sufficient to get rid of the débris. The 8-in. pumps in use raise gravel, &c., to a height of 40 ft., and are specially made, having renewable shoes on the impellers and renewable liners in the casings.

The pumps are direct coupled to 50-h.p. motors, running at 480 r.p.m. The motors are 200 volts, and are supplied from a step-down transformer. The whole of this equipment is fixed on what is called a "pontoon." The overhead power line is brought within a distance of about 80 yards

to the point where it is used, and a cable is connected to the line through controlling links and brought to the pontoon and connected through oil switches, &c., to the apparatus. The pontoons are square wooden structures, heavily built, and are about 18 ft. square, containing the pump and motor at one end, and the transformer and switch-gear at the other end. The lower portion of the pontoon is made water-tight, and has a displacement large enough to float the whole pontoon when necessary. The pontoon is enclosed and roofed in to protect electrical apparatus from the weather. During operations it rests on a flat area of ground prepared for it, the suction pipe being taken to a suitable sump dug out in the river-bed, while the delivery pipe is taken to the head box which feeds the sluice-boxes, &c. The high-pressure water service used for "hydraulicing" is obtained from water-races, and the most advantageous pressure is about 70 lb. per sq. in.; but although the Swaziland Tin, Ltd., is fortunate in having, for most of its workings, such water supply, there are instances where such water pressure is not available, and in these instances pressure obtained by a high lift pump is resorted to. Such pumps supply approximately 700 gallons per minute at 70 lb. pressure at the nozzle, and are driven by 100-h.p. motors. Another instance where artificial pressure has to be obtained during the dry season is where a direct-coupled pump is also placed on one of the pontoons, and the pump drawing its water from a dam where settled water is obtained, and the delivery pipe line is within easy distance of the working face.

The Engineer's report of the working of the apparatus shows a considerable gain in efficiency since installing the electrical plant. In fact, the gravel pumps actually did 60 per cent. more work than the hydraulic elevator for a given quantity of water power, whilst, of course, the same water (which formerly ran to waste) after generating power for the gravel pumps is used in breaking and elevating ground.

ELECTRICAL MINING AND METALLURGICAL PATENTS OF MAY

Mining.

IN Specification No. 17,889 of 1913, H. H. Hirsch describes a form of electric lamp for mounting on a miner's cap in a hermetically sealed case with reflector and lens, provided with an internal switch normally operated from outside, but arranged so as to break the circuit on fracture of a thin panel of glass behind the lens, which breaks when the case is deformed by a blow.

In No. 9,542 of 1914, A. Mond describes a method of flame-tight protection of motors communicated by the Oerlikon Co. (Switzerland). This is a form of "plate protection" in which the openings are protected by layers of sheet-steel built of short lengths, spaced apart by the interposition of other plates only at the ends. By this means more accurate spacing is attained than by the use of plates the full width of the aperture to be protected.

A form of relay for mine signalling is described by H. Davies and M. J. Railing in Specification No. 10,549 of 1914. The electromagnet has two parallel limbs, and a special shaped armature is mounted on an axis parallel to the limbs, and is rotatable in front of a parallel to the pole-faces. This works a contact which controls the circuit. The magnet limbs have a short-circuited winding or conducting sleeve, which limits the inductive rise of voltage to an extent which renders the external spark where the circuit is broken free from liability to cause ignition of gas.

Specification No. 11,599 of 1914 of L. Bristol describes an electric miner's safety lamp, among the features of which are a strip of acid-proof material between the vent holes and the terminals, and a hinged cover adapted to be locked in position and provided with additional locking means which must be operated before the cover can be moved on its hinge, and having mounted thereon a gas-tight rotary or partly rotary switch. The cover rests on a rim which maintains the lamp-support and guard in position, and is provided with a projecting pin which coincides with a hole in a movable slide locked in position by the closing of the cover.

Electro-metallurgical.

In Specification No. 18,538 of 1914, A. P. Strohmenger describes an improved method of arc welding or fusion deposition of metals, in which an electrode is used of the

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material to be deposited, and certain difficulties are overcome by incorporating in the electrode a strip of aluminium or other suitable material having a strong reducing effect at the arc temperature.

Safety Lamps for Mines.—One of the flame lamps recently approved for use in mines by the Home Office is noticeable for having a small electric lamp of the "torch" type, with a primary battery attached to it for use in emergencies when the flame becomes extinguished. This torch is mounted on a pivot to throw light in any direction, and is approved subject to the conditions that "the cover of the battery case is securely soldered on, that the protecting glass is securely fastened and forms a flame-tight joint with the case, and that the push switch is flame-tight."

Electric Mining Regulations and Data.—A very convenient little pocket-book with this title is being issued by W. T. Glover and Co., Ltd. (Trafford Park, Manchester). It contains the latest Home Office regulations in full with the official explanatory memorandum thereon, as well as a quantity of data of utility to the mining electrical engineer, especially in relation to the choice of cables. A selection of illustrations of typical cables, accessories, and fittings are also given.

The Electric Vehicle Committee.—At a recent meeting of this Committee arrangements were discussed for the proposed Parade of Electric Vehicles on June 17th, and the time was provisionally fixed for 5 p.m. Application will be made for permission from the police for the Parade to be held on the Embankment. The Technical Sub-Committee have now completed the preparation of the report upon "Methods of Charging and Charging Equipment." As to further standardising of details appertaining to lead plate batteries, the Committee has decided to ask the Accumulator Section of the B.E.A.M.A. to consider the desirability of bringing about standardisation in regard to:—The clearance for the accumulation of sludge between the lower edge of the plates and the bottom of the cell container; the size of the filler plug hole and the design of the plug; the distance between the top of the lip of the plug hole and the top edges of the plates, so that one gauge may always be used in a garage for fixing the proper level of the electrolyte, measuring from the top edge of the filler hole lip, and details of connectors between cells and method of connecting these to the plate terminals. The next meeting of the Committee was fixed for 3 p.m. on June 11th, 1915.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,445.

Explain how to reverse the direction of rotation of a single-phase induction motor with squirrel-cage rotor, also of a single-phase repulsion motor with a D.C. armature, which is permanently short-circuited.—"J. B."

(Replies must be received not later than first post, Thursday, June 10th.)

ANSWERS TO No. 1,443.

No reply of sufficient merit for an award has been received.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The following description of wireless communication from German submarines, extracted from an Irish contemporary, may amuse our readers:—"In the Furken Telegraaf system employed by the Germans a high aerial is not required, and it is probable that this fact has enabled them to use it on submarines floating on the surface. From the top of a pole of no great length a small captive balloon is sent into the air, and the wire from the transmitting instrument runs only to the pole. As the message leaves the instrument it goes to the pole, and from there is extracted to the balloon by means of a magnet, which re-transmits it by means of flashes to another similar installation."

The directors of the Constantinople Telephone Co. have issued a circular to their shareholders, in which they refer to the fact that the General Manager (Mr. Douglas Watson) and the British staff were expelled from the Company's premises in Constantinople, and have now arrived in England. The Constantinople directors have protested to the Turkish Government, and it is hoped that it will soon be possible for the British staff to return, and for the Company to resume possession of its plant. An endeavour is also to be made to obtain reparation for the loss inflicted by the action of the Turkish Government. The matter is receiving the careful consideration of the European directors, and every possible step has been and will be taken to protect the interests of the shareholders and bondholders.

The Chicago Journal *Telephony* of April 24th contains an exceedingly useful article by Mr. W. N. Furthmann, describing the design and construction of loading coils used in America. It is devoted to the mechanical construction rather than the electrical design of these coils, although mention is made incidentally of the fact that the coils are divided into seven sections (14 in the case of the coils for the "phantom" circuit) to avoid cross-talk. The coils are mounted on wooden dowels clamped at the top and to an

iron spider, but separated from it by wooden washers, and at the lower end a wooden nut is used for clamping the dowel to the case. This is to avoid eddy currents, as the case is of iron for mechanical reasons. Two fibre washers with an iron washer between them are placed between the coils, the iron acting as magnetic shields between the coils. All these parts, and the method of assembling, mounting, and cabling have been standardised, as have also been, to a large extent, the cases for containing the loading coils for land-lines, underground, and submarine cables respectively.

A Paper on "Wireless Call Devices," by Mr. L. B. Turner, was read at a recent meeting of the Institution of Post Office Electrical Engineers. The author said that the primary difficulty in devising an effective call apparatus was the extreme smallness of the power available, and a secondary difficulty was how to avoid fake calls actuated by foreign wireless stations discharging their ordinary traffic or by atmospherics. He reviewed a number of directions in which attempts had been made to actuate a call signal by received messages. It was comparatively easy to actuate a bell by the old style of coherer, but such a receiver was not nearly sensitive enough for present-day work. The power received by the ordinary telephone was not of the order required to actuate the usual Post Office relay, but such instruments as the Orling jet relay, the Brown telephone relay, the Heurtley amplifier, depending on the change of resistance, produced in a hot thin platinum wire when slightly displaced across the edge of a blast of cold air, or the Lieben-Reiss vacuum-tube amplifier, might be employed. A certain amount of selectivity was necessary, and the simplest arrangement was to use a long "dash" as the call signal, and to arrange the receiving apparatus so that it did not respond to a short signal. Another method depended on musical note syntaxy, and an analogous device was that responding only to "dashes" at regular intervals. There was considerable need for a reliable call apparatus in out-of-the-way Post Office stations, and an appliance was shown which had been developed for the purpose. In the apparatus a clock switches in a crystal detector circuit with a very sensitive slow-period galvanometer in place of the telephone for $7\frac{1}{2}$ seconds four times an hour, and when the sending key is depressed throughout this period the galvanometer needle is deflected into a position between two jaws of a hit-and-miss device actuated by a local current. When the needle is in its deflected position, the closing of the jaws is without effect, for the jaws are slightly staggered, but if the needle is in place between them, it is gripped and a local circuit is closed, ringing a bell. A second crystal detector is provided, and the two are automatically switched in alternately by an ingenious mercury-actuated switch in case of one being damaged by atmospherics. Another apparatus was also described, in which the swing of a galvanometer is gradually built up from the sending station by keeping the key depressed every alternate five seconds. With a signal of .063 microampere a call can be made in this way in $2\frac{1}{2}$ minutes.

The appointment of Sir Henry Jackson to succeed Lord Fisher as First Sea Lord of the Admiralty recalls that Sir Henry was the first to develop the use of wireless telegraphy in the Navy. His first experiments were carried out in the early 'nineties, and by the time he worked in conjunction with Mr. Marconi, in 1896, he was able to communicate from one end of a ship to the other. Sir Henry Jackson relinquished the control of wireless telegraphy in the Navy in 1906, when he was appointed Rear-Admiral.

Diesel Engine Users' Association.—At the May meeting of the Diesel Engine Users' Association the President reported that particulars of the scheme of insurance at Lloyds against breakdown had been sent out to all the members. The question of a suitable allowance to be made for depreciation of Diesel engine plant in connection with income tax assessment was discussed, and its further consideration was adjourned for the following meeting. The subject of lubrication of Diesel engines was further dealt with. Replies and information on several interesting points had been received from many of the members of the Association, and much valuable information had been obtained as to the various methods of lubricating, the costs per unit generated, comparative costs of lubrication as compared with fuel oil used, the practice in regard to withdrawal of pistons for examination, &c. It was decided to extend the time for sending in returns from other undertakings, and to ask for some further information in certain cases, so as to obtain results which would represent general practice as far as possible. At the next meeting of the Association on Wednesday, June 16th, the question of cracked pistons will come up for discussion. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19 Cadogan Gardens, London, S.W.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 27th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

7,298/14. Lamp-holders. R. B. BENJAMIN. Edison screw lamp-holders provided with springs for clamping the lamp against loosening by vibration. The springs project through slots in the screwed contact sleeve and bear on the lamp cap. Several patterns of spring are described. (Nine figures.)

11,083/14. Travelling Searchlights. Soc. ANON. DES AUTOMOBILES & CYCLES PEUGEOT. A motor vehicle in which a petrol engine is employed for driving a dynamo, as well as for propulsion. The projector is mounted on a wheeled truck, which is carried complete on the rear part of the vehicle, and an inclined track can be lowered to let down or take up the truck with the aid of a windlass. (Seven figures.)

11,399/14. Constant Voltage Generator. CROMPTON & Co., LTD., and N. PENSABENE. A self-regulating D.C. generator in which the brushes are placed at an angle of 60° or 70° with the neutral position, and a number of equally spaced tappings on the armature winding are connected by non-inductive resistances so that the combination of the A.C. and D.C. reactions produces a compensating effect. (One figure.)

14,159/14. Fuses. A. H. RAILING and C. C. GARRARD. Fuses of the hand-shield type with ventilating channels in the contact blocks. The blocks are mounted on the carrier, and support between them, by means of holes in their ends, asbestos protecting tubes. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, and TRANSFORMERS: B.T.-H. Co. and CLOUGH [Protective devices for alternators] 11,436/14.

Electrometallurgy and Electrochemistry: HANRIOT [Electrochemical treatment of ores] 11,950/14.

Heating and Cooking: MILLER and MILLER [Electrically heated shaving-pots] 22,915/14; VANDERVELL [Cigar-lighters] 3,672/14.

Switchgear, Fuses, and Fittings: MORRIS and MORRIS & LISTER, LTD. [Circuit-breakers] 11,794/14; B.T.-H. Co. (G.E.CO., U.S.A.)

ELECTRIC TRACTION NOTES

Among the features of novelty in the passenger cars of the New York Municipal Railway Corporation, described in the *Electric Railway Journal*, are an automatic adjustment of the brake cylinder pressure according to the load in the car actuated by the deformation of the springs while the car is standing with the doors open; an automatic coupler which couples up all the brake pipes and electrical connections in the same operation as the main coupling; electro-pneumatic door operation with push-button control; and an automatic arrangement whereby the head and tail lights are caused both to show red when the reversing handle of the controller is put in the centre position, and when the train is broken the red lights at the point of separation automatically light up. When the controller is put in the running position the lights in the corresponding forward end of the train light up white. Another important feature is the automatic speed-control and cab-signalling system, which supplements the ordinary fixed signals and train stops, and gives the driver information as to when to apply brakes, when to resume normal speed, the permissible speed, the available braking distance, &c. This is contrived with a speed-control

[Protective devices] 11,832/14; RAILING and TAYLOR [Conduits] 18,143/14; MIDGEY and VANDERVELL [Automatic cut-outs] 21,488/14; BARNUM and DATE [Switches] 22,435/14.

Telephony and Telegraphy: ARNO [Generating oscillations] 11,928/14; MANDERS [Method of producing oscillatory currents of small decrement and close wave trains] 11,934/14; COHEN [Production of oscillatory currents of high frequency] 18,433/14.

Traction: BILES [Petrol-electric system] 10,275/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Traction insulators] 11,739/14.

Miscellaneous: LICHTENFELD BURGLAR ALARM Co. and LICHTFIELD [Burglar alarms] 16,853/14; BENITEZ [System for the generation of electric currents] 17,811/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Ignition: TEBBITT [Ignition devices] 5,850/15.
Instruments, Meters, &c.: WESSEL [Coin operated meter] 6,685/15.

Telephony and Telegraphy: GOLDSCHMIDT [Mechanical selector for electromagnetic waves applicable to wireless receiving apparatus] 15,082/14.

Application for Restoration of Lapsed Patent

17,817/07. Mounting of Metal Filaments. A. C. HYDE and VACTITE WIRE Co., LTD. Application has been made for the restoration of this patent, which had been allowed to lapse. The specification describes a method of fixing metal filaments to the supporting wires by a paste containing gelatinous metallic hydrates, afterwards acted upon by an arc in hydrogen. Opposition to the restoration must be entered by July 27th.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: L. C. H. MENSING [Flame arc lamps] 3,243/04 and [Arc lamp magazine] 25,373/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: C. J. BEAVER and E. A. CLAREMONT [Oil-proof coating between the indiarubber insulation and outer cover of cables] 2,747/05; E. WITZENMANN [Cable armouring] 3,257/09.

Dynamos, Motors and Transformers: E. S. G. REES [Dynamo frame] 3,157/05; W. GEIPEL and F. M. T. LANGE [D.C. motor control] 3,177/05; B.T.-H. Co. (G.E. Co., U.S.A.) [A.C. motor control] 3,590/06.

Switchgear, Fuses and Fittings: C. H. PEARSON [Conduit tube joints] 3,520/07.

Telephony and Telegraphy: G. W. PICKARD [Wireless receiver] 2,943/08.

Traction: W. M. MORDEY [A.C. traction booster system] 3,748/02; H. LEITNER [Train lighting dynamo] 3,391/08.

system which automatically applies the brakes if the driver fails to obey the cab-signal indications and the speed of the car at any point is in excess of that established by a pre-determined braking curve. The apparatus involves a centrifugal governor acting in conjunction with a cam of special form and certain relays and contacts, and is not as complicated as might appear at first sight.

An agreement has been come to between the new Plymouth Corporation and the Devonport & District Tramways Co. for the sale of the Company's undertaking to the Corporation on Tramway Act terms. The arrangement at present is that the Company's line shall be transferred to the Corporation on October 7th, the price to be fixed by arbitration.

The strike of the London County Council tramwaymen came to a sudden termination on Saturday, when the unions instructed the men to return to work. A message to that effect was therefore telephoned to Mr. A. L. C. Fell, the Chief Officer. Meanwhile, the L.C.C. had issued a notice that no man of military age would be re-engaged, and some trouble arose on Sunday and Monday in regard to this. The result was that the union called out the men again, but the L.C.C., whilst not modifying its attitude, has agreed to consider reasons put forward by any man of military age for not joining the Army. The men have also returned on the Metropolitan electric tramway system, it is said without restrictions as to age.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

■ COLLIERY LIGHTING

A PAPER on colliery electric lighting, by Mr. C. S. Corlett, was read recently at a joint meeting of the North Staffordshire Branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers. The author described some early experiences with underground and surface lighting as far back as 1883, and went on to refer to the Home Office Rules with regard to underground lighting. While there might be differences of opinion, he said, on points of detail, the main principles were such as to ensure good and reliable work. The Home Office Factory Rules should be followed for surface work. The essentials of a properly-arranged distribution system were: That feeder cables should be run from a main switchboard or main control board to suitable double-pole distributing fuse-boxes; that no lamps should be connected to the feeder circuits; and that branch circuits for not more than 10 points should be run from the distribution boxes to the lamps. In the author's opinion, the best method of protecting the internal wiring at a colliery was by means of well-arranged screwed piping, and for particularly exposed or damp situations, galvanised piping. Open wiring supported on cleat or other types of insulators had given reasonably satisfactory results, yet the absence of mechanical protection to the wires was a serious objection. A frequent example of bad workmanship was the indiscriminate bunching of wires at the back of switchboards, or in the vicinity of distributing centres. Plain pendant fittings were unsuited to dusty situations; it was better to use totally enclosed dustproof fittings. Where there was much vibration, short lengths of metallic flexible tubing would prevent damage to the lamps.

Although the standard of maintenance was improving, the following practices were often observed:—The use of fuse wire of incorrect size; not keeping the box-covers properly screwed down so as to exclude dust; and omission to replace broken outer globes. The author considered that better results would be obtained by improving the status of the colliery electrician, whose remuneration was often quite inadequate, and by giving him actual instead of nominal charge of his department.

The carbon lamp might be said now to have had its day, and for present requirements only the metal filament lamp need be considered. In the smaller sizes, those for 100/110 volts were more satisfactory than those for 220/250 volts. The former was the most suitable pressure for colliery work, and could easily be provided on A.C. systems by transformers. In D.C. systems the problem was not so easy. It was not always economical to have separate plant for lighting, but a suitable lighting voltage could often be obtained by the use of a balancer. The arrangement of lamps in series on the power mains was not good practice. The use of 110 volts for lighting had the advantage that the rule as to earthing did not apply at this pressure. Self-contained lighting transformers, complete with switches and fuses in one cast-iron case with several compartments, could be conveniently used fixed alongside the ironclad power-control switches in the sub-stations and connected to the bus-bars through a few inches of piping. Rule 129 (c) stated that all conductors must be of the concentric type or provided with a metal covering, excepting only such portions of the low-tension system as are not fixed on roadways used for mechanical haulage, and where no danger exists for firing gas or other inflammable materials. The author further remarked that it is seldom desirable to limit the lighting system so that no portion of it will be on a haulage road—as excepting for loading into the cages it is probable that at the terminals of the haulages the greatest advantage of electric lighting accrues. It was, he said, undesirable to have a mixed system, that is to say, protected wires on one roadway, unprotected wiring on the next. It may therefore be concluded that, excepting concentric wiring, practically all colliery underground lighting must be protected with a metallic covering enclosing the whole of the conductors in the circuit. Speak-

ing broadly, the choice of this protection is limited to two types—steel tubing and armouring of the cables. Excepting on masonry or on the steel-girdered roofs of motor-houses the use of tubing is inadvisable.

The author has used twin-armoured conductors with satisfactory results. The conductors consist of circular twin V.I.R. cables, armoured and braided overall, and are carried on the usual form of suspender in convenient positions along the roadways, generally at the side, and as close to the roof as possible. At each lamp the branch distributor cable is cut and a circular galvanised-iron box is fitted, provided with suitable cover and suitable insulated connectors inside. In many cases an ordinary 3-way conduit box has been used. The insulated conductors are brought inside through a suitable gland, the armouring being terminated on the outside by a suitable armour clamp; the third or tee opening is provided with a short length of tubing, the other end of which is screwed into the lamp fitting. In cases where rigid tubing may be undesirable or difficult, short lengths of flexible tubing can be employed. At the last lamp on the circuit the blank outlet can be fitted with a plug, and at points where more than one lamp is required 4-way instead of 3-way boxes can be furnished. Only a small amount of concentric wiring has been carried out in collieries.

ELECTRIC POWER IN A SOUTH AFRICAN TIN MINE

A PAPER by Mr. W. Elsdon-Dew, published in the Transactions of the South African Institute of Electrical Engineers, describes the application of electrical power to the operations of Swaziland Tin, Ltd., M'Babane. The tin recovered is all alluvial, and occurs over a very wide area at points at considerable distances apart. Water power from one of the numerous streams from the eastern slopes of the Drakensberg range of mountains is utilised by a 300-h.p. Pelton wheel running under an effective head of 500 ft. at 500 r.p.m., and driving a 250-k.v.a. 550-volt 50-cycle three-phase alternator with a direct-coupled exciter. Power from this plant is transformed up by a single transformer to 3,300 volts and transmitted in different directions, the greatest distance being about 3½ miles, by overhead wires. Power is used for driving centrifugal gravel pumps and high-pressure nozzle pumps for sluicing down gravel. The exciter has a capacity in excess of the excitation requirements, and is used for station lighting and auxiliary services. The transmission line is of aluminium 7'0 11¼ sq. in., and in the particular circumstances a saving of 22 per cent. was made over the cost of an equivalent copper line, although the cost of supports and handling the aluminium was higher than it would have been for copper. The lines extend to three districts, named "Grey's Creek," "M'Babane Flats," and "King's Flats," where the workings for alluvial tin require motive power in some form or other. The tin is obtained out of the river wash in the following manner:—

The tin is finely divided in particles, varying from $\frac{1}{4}$ -in. cubes down to very fine particles, and, being heavy, settles in the bottom of this stream, provided the method of handling allows for this. The usual method of washing down the river deposit and passing it through boxes containing riffles, &c., is adopted, but unless there is a considerable fall in the river-bed the debris soon chokes operations. Power is therefore used for raising the gravel out of the river-bed by means of gravel pumps to suitable places where the fall from the sluice-boxes is sufficient to get rid of the debris. The 8-in. pumps in use raise gravel, &c., to a height of 40 ft., and are specially made, having renewable shoes on the impellers and renewable liners in the casings.

The pumps are direct coupled to 50-h.p. motors, running at 480 r.p.m. The motors are 200 volts, and are supplied from a step-down transformer. The whole of this equipment is fixed on what is called a "pontoon." The overhead power line is brought within a distance of about 60 yards

to the point where it is used, and a cable is connected to the line through controlling links and brought to the pontoon and connected through oil switches, &c., to the apparatus. The pontoons are square wooden structures, heavily built, and are about 18 ft. square, containing the pump and motor at one end, and the transformer and switch-gear at the other end. The lower portion of the pontoon is made water-tight, and has a displacement large enough to float the whole pontoon when necessary. The pontoon is enclosed and roofed in to protect electrical apparatus from the weather. During operations it rests on a flat area of ground prepared for it, the suction pipe being taken to a suitable sump dug out in the river-bed, while the delivery pipe is taken to the head box which feeds the sluice-boxes, &c. The high-pressure water service used for "hydraulicing" is obtained from water-races, and the most advantageous pressure is about 70 lb. per sq. in.; but although the Swaziland Tin, Ltd., is fortunate in having, for most of its workings, such water supply, there are instances where such water pressure is not available, and in these instances pressure obtained by a high lift pump is resorted to. Such pumps supply approximately 700 gallons per minute at 70 lb. pressure at the nozzle, and are driven by 100-h.p. motors. Another instance where artificial pressure has to be obtained during the dry season is where a direct-coupled pump is also placed on one of the pontoons, and the pump drawing its water from a dam where settled water is obtained, and the delivery pipe line is within easy distance of the working face.

The Engineer's report of the working of the apparatus shows a considerable gain in efficiency since installing the electrical plant. In fact, the gravel pumps actually did 60 per cent. more work than the hydraulic elevator for a given quantity of water power, whilst, of course, the same water (which formerly ran to waste) after generating power for the gravel pumps is used in breaking and elevating ground.

ELECTRICAL MINING AND METALLURGICAL PATENTS OF MAY

Mining.

IN Specification No. 17,889 of 1913, H. H. Hirsch describes a form of electric lamp for mounting on a miner's cap in a hermetically sealed case with reflector and lens, provided with an internal switch normally operated from outside, but arranged so as to break the circuit on fracture of a thin panel of glass behind the lens, which breaks when the case is deformed by a blow.

In No. 9,542 of 1914, A. Mond describes a method of flame-tight protection of motors communicated by the Oerlikon Co. (Switzerland). This is a form of "plate protection" in which the openings are protected by layers of sheet-steel built of short lengths, spaced apart by the interposition of other plates only at the ends. By this means more accurate spacing is attained than by the use of plates the full width of the aperture to be protected.

A form of relay for mine signalling is described by H. Davies and M. J. Railing in Specification No. 10,549 of 1914. The electromagnet has two parallel limbs, and a special shaped armature is mounted on an axis parallel to the limbs, and is rotatable in front of a parallel to the pole-faces. This works a contact which controls the circuit. The magnet limbs have a short-circuited winding or conducting sleeve, which limits the inductive rise of voltage to an extent which renders the external spark where the circuit is broken free from liability to cause ignition of gas.

Specification No. 11,599 of 1914 of L. Bristol describes an electric miner's safety lamp, among the features of which are a strip of acid-proof material between the vent holes and the terminals, and a hinged cover adapted to be locked in position and provided with additional locking means which must be operated before the cover can be moved on its hinge, and having mounted thereon a gas-tight rotary or partly rotary switch. The cover rests on a rim which maintains the lamp-support and guard in position, and is provided with a projecting pin which coincides with a hole in a movable slide locked in position by the closing of the cover.

Electro-metallurgical.

In Specification No. 13,538 of 1914, A. P. Strohmenger describes an improved method of arc welding or fusion deposition of metals, in which an electrode is used of the

FOR
BRITISH
MANUFACTURED
PAPER
INSULATED
CABLES
THE UNION
CABLE
CO., LTD
DAGENHAM DOCK,
ESSEX.

material to be deposited, and certain difficulties are overcome by incorporating in the electrode a strip of aluminium or other suitable material having a strong reducing effect at the arc temperature.

Safety Lamps for Mines.—One of the flame lamps recently approved for use in mines by the Home Office is noticeable for having a small electric lamp of the "torch" type, with a primary battery attached to it for use in emergencies when the flame becomes extinguished. This torch is mounted on a pivot to throw light in any direction, and is approved subject to the conditions that "the cover of the battery case is securely soldered on, that the protecting glass is securely fastened and forms a flame-tight joint with the case, and that the push switch is flame-tight."

Electric Mining Regulations and Data.—A very convenient little pocket-book with this title is being issued by W. T. Glover and Co., Ltd. (Trafford Park, Manchester). It contains the latest Home Office regulations in full with the official explanatory memorandum thereon, as well as a quantity of data of utility to the mining electrical engineer, especially in relation to the choice of cables. A selection of illustrations of typical cables, accessories, and fittings are also given.

The Electric Vehicle Committee.—At a recent meeting of this Committee arrangements were discussed for the proposed Parade of Electric Vehicles on June 17th, and the time was provisionally fixed for 5 p.m. Application will be made for permission from the police for the Parade to be held on the Embankment. The Technical Sub-Committee have now completed the preparation of the report upon "Methods of Charging and Charging Equipments." As to further standardising of details appertaining to lead plate batteries, the Committee has decided to ask the Accumulator Section of the B.E.A.M.A. to consider the desirability of bringing about standardisation in regard to:—The clearance for the accumulation of sludge between the lower edge of the plates and the bottom of the cell container; the size of the filler plug hole and the design of the plug; the distance between the top of the lip of the plug hole and the top edges of the plates, so that one gauge may always be used in a garage for fixing the proper level of the electrolyte, measuring from the top edge of the filler hole lip, and details of connectors between cells and method of connecting these to the plate terminals. The next meeting of the Committee was fixed for 3 p.m. on June 11th, 1915.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,443.

Explain how to reverse the direction of rotation of a single-phase induction motor with squirrel-cage rotor, also of a single-phase repulsion motor with a D.C. armature, which is permanently short-circuited.—"J. B."

(Replies must be received not later than first post, Thursday, June 10th.)

ANSWERS TO No. 1,443.

No reply of sufficient merit for an award has been received.

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The Chicago Journal *Telephony* of April 24th contains an exceedingly useful article by Mr. W. N. Furthmann, describing the design and construction of loading coils used in America. It is devoted to the mechanical construction rather than the electrical design of these coils, although mention is made incidentally of the fact that the coils are divided into seven sections (14 in the case of the coils for the "phantom" circuit) to avoid cross-talk. The coils are mounted on wooden dowels clamped at the top and to an

iron spider, but separated from it by wooden washers, and at the lower end a wooden nut is used for clamping the dowel to the case. This is to avoid eddy currents, as the case is of iron for mechanical reasons. Two fibre washers with an iron washer between them are placed between the coils, the iron acting as magnetic shields between the coils. All these parts, and the method of assembling, mounting, and cabling have been standardised, as have also been, to a large extent, the cases for containing the loading coils for land-lines, underground, and submarine cables respectively.

A Paper on "Wireless Call Devices," by Mr. L. B. Turner, was read at a recent meeting of the Institution of Post Office Electrical Engineers. The author said that the primary difficulty in devising an effective call apparatus was the extreme smallness of the power available, and a secondary difficulty was how to avoid fake calls actuated by foreign wireless stations discharging their ordinary traffic or by atmospherics. He reviewed a number of directions in which attempts had been made to actuate a call signal by received messages. It was comparatively easy to actuate a bell by the old style of coherer, but such a receiver was not nearly sensitive enough for present-day work. The power received by the ordinary telephone was not of the order required to actuate the usual Post Office relay, but such instruments as the Orling jet relay, the Brown telephone relay, the Heurtley amplifier, depending on the change of resistance, produced in a hot thin platinum wire when slightly displaced across the edge of a blast of cold air, or the Lieben-Reiss vacuum-tube amplifier, might be employed. A certain amount of selectivity was necessary, and the simplest arrangement was to use a long "dash" as the call signal, and to arrange the receiving apparatus so that it did not respond to a short signal. Another method depended on musical note syntony, and an analogous device was that responding only to "dashes" at regular intervals. There was considerable need for a reliable call apparatus in out-of-the-way Post Office stations, and an appliance was shown which had been developed for the purpose. In the apparatus a clock switches in a crystal detector circuit with a very sensitive slow-period galvanometer in place of the telephone for $7\frac{1}{2}$ seconds four times an hour, and when the sending key is depressed throughout this period the galvanometer needle is deflected into a position between two jaws of a hit-and-miss device actuated by a local current. When the needle is in its deflected position, the closing of the jaws is without effect, for the jaws are slightly staggered, but if the needle is in place between them, it is gripped and a local circuit is closed, ringing a bell. A second crystal detector is provided, and the two are automatically switched in alternately by an ingenious mercury-actuated switch in case of one being damaged by atmospherics. Another apparatus was also described, in which the swing of a galvanometer is gradually built up from the sending station by keeping the key depressed every alternate five seconds. With a signal of .063 microampere a call can be made in this way in $2\frac{1}{2}$ minutes.

The appointment of Sir Henry Jackson to succeed Lord Fisher as First Sea Lord of the Admiralty recalls that Sir Henry was the first to develop the use of wireless telegraphy in the Navy. His first experiments were carried out in the early 'nineties, and by the time he worked in conjunction with Mr. Marconi, in 1896, he was able to communicate from one end of a ship to the other. Sir Henry Jackson relinquished the control of wireless telegraphy in the Navy in 1906, when he was appointed Rear-Admiral.

Diesel Engine Users' Association.—At the May meeting of the Diesel Engine Users' Association the President reported that particulars of the scheme of insurance at Lloyds against breakdown had been sent out to all the members. The question of a suitable allowance to be made for depreciation of Diesel engine plant in connection with income tax assessment was discussed, and its further consideration was adjourned for the following meeting. The subject of lubrication of Diesel engines was further dealt with. Replies and information on several interesting points had been received from many of the members of the Association, and much valuable information had been obtained as to the various methods of lubricating, the costs per unit generated, comparative costs of lubrication as compared with fuel oil used, the practice in regard to withdrawal of pistons for examination, &c. It was decided to extend the time for sending in returns from other undertakings, and to ask for some further information in certain cases, so as to obtain results which would represent general practice as far as possible. At the next meeting of the Association on Wednesday, June 16th, the question of cracked pistons will come up for discussion. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19 Cadogan Gardens, London, S.W.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published May 27th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

7,298/14. Lamp-holders. R. B. BENJAMIN. Edison screw lamp-holders provided with springs for clamping the lamp against loosening by vibration. The springs project through slots in the screwed contact sleeve and bear on the lamp cap. Several patterns of spring are described. (Nine figures.)

11,083/14. Travelling Searchlights. Soc. ANON. DES AUTOMOBILES & CYCLES PEUGEOT. A motor vehicle in which a petrol engine is employed for driving a dynamo, as well as for propulsion. The projector is mounted on a wheeled truck, which is carried complete on the rear part of the vehicle, and an inclined track can be lowered to let down or take up the truck with the aid of a windlass. (Seven figures.)

11,399/14. Constant Voltage Generator. CROMPTON & Co., LTD., and N. PENSABENE. A self-regulating D.C. generator in which the brushes are placed at an angle of 60° or 70° with the neutral position, and a number of equally spaced tappings on the armature winding are connected by non-inductive resistances so that the combination of the A.C. and D.C. reactions produces a compensating effect. (One figure.)

14,159/14. Fuses. A. H. RAILING and C. C. GARRARD. Fuses of the hand-shield type with ventilating channels in the contact blocks. The blocks are mounted on the carrier, and support between them, by means of holes in their ends, asbestos protecting tubes. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: B.T.-H. Co. and CLOUGH [Protective devices for alternators] 11,436/14.

Electrometallurgy and Electrochemistry: HANRIOT [Electrochemical treatment of ores] 11,950/14.

Heating and Cooking: MILLER and MILLER [Electrically heated shaving-pots] 22,915/14; VANDERVELL [Cigar-lighters] 3,672/14.

Switchgear, Fuses, and Fittings: MORRIS and MORRIS & LISTER, LTD. [Circuit-breakers] 11,794/14; B.T.-H. Co. (G.E. Co., U.S.A.)

[Protective devices] 11,832/14; RAILING and TAYLOR [Conduits] 18,143/14; MIDGEY and VANDERVELL [Automatic cut-outs] 21,488/14; BARNUM and DATE [Switches] 22,435/14.

Telephony and Telegraphy: ARNO [Generating oscillations] 11,928/14; MANDERS [Method of producing oscillatory currents of small decrement and close wave trains] 11,934/14; COHEN [Production of oscillatory currents of high frequency] 19,433/14.

Traction: BILES [Petrol-electric system] 10,275/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Traction insulators] 11,739/14.

Miscellaneous: LICHTENFELD BURGLAR ALARM Co. and LICHTFIELD [Burglar alarms] 16,833/14; BENITEZ [System for the generation of electric currents] 17,811/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Ignition: TEBBITT [Ignition devices] 5,850/15.

Instruments, Meters, &c.: WESSEL [Coin operated meter] 6,685/15.

Telephony and Telegraphy: GOLDSCHMIDT [Mechanical selector for electromagnetic waves applicable to wireless receiving apparatus] 15,082/14.

Application for Restoration of Lapsed Patent

17,817/07. Mounting of Metal Filaments. A. C. HYDE and VACTITE WIRE Co., LTD. Application has been made for the restoration of this patent, which had been allowed to lapse. The specification describes a method of fixing metal filaments to the supporting wires by a paste containing gelatinous metallic hydrates, afterwards acted upon by an arc in hydrogen. Opposition to the restoration must be entered by July 27th.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: L. C. H. MENSING [Flame arc lamps] 3,243/04 and [Arc lamp magazine] 25,373/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: C. J. BEAVER and E. A. CLAREMONT [Oil-proof coating between the indiarubber insulation and outer cover of cables] 2,747/05; E. WITZENMANN [Cable armouring] 3,257/09.

DYNAMOS, MOTORS AND TRANSFORMERS: E. S. G. REES [Dynamo frame] 3,157/05; W. GEIPEL and F. M. T. LANGE [D.C. motor control] 3,177/05; B.T.-H. Co. (G.E. Co., U.S.A.) [A.C. motor control] 3,590/06.

Switchgear, Fuses and Fittings: C. H. PEARSON [Conduit tube joints] 3,520/07.

Telephony and Telegraphy: G. W. PICKARD [Wireless receiver] 2,943/08.

Traction: W. M. MORDEY [A.C. traction booster system] 3,748/02; H. LEITNER [Train lighting dynamo] 3,391/08.

ELECTRIC TRACTION NOTES

Among the features of novelty in the passenger cars of the New York Municipal Railway Corporation, described in the *Electric Railway Journal*, are an automatic adjustment of the brake cylinder pressure according to the load in the car actuated by the deformation of the springs while the car is standing with the doors open; an automatic coupler which couples up all the brake pipes and electrical connections in the same operation as the main coupling; electro-pneumatic door operation with push-button control; and an automatic arrangement whereby the head and tail lights are caused both to show red when the reversing handle of the controller is put in the centre position, and when the train is broken the red lights at the point of separation automatically light up. When the controller is put in the running position the lights in the corresponding forward end of the train light up white. Another important feature is the automatic speed-control and cab-signalling system, which supplements the ordinary fixed signals and train stops, and gives the driver information as to when to apply brakes, when to resume normal speed, the permissible speed, the available braking distance, &c. This is contrived with a speed-control

system which automatically applies the brakes if the driver fails to obey the cab-signal indications and the speed of the car at any point is in excess of that established by a pre-determined braking curve. The apparatus involves a centrifugal governor acting in conjunction with a cam of special form and certain relays and contacts, and is not as complicated as might appear at first sight.

An agreement has been come to between the new Plymouth Corporation and the Devonport & District Tramways Co. for the sale of the Company's undertaking to the Corporation on Tramway Act terms. The arrangement at present is that the Company's line shall be transferred to the Corporation on October 7th, the price to be fixed by arbitration.

The strike of the London County Council tramwaymen came to a sudden termination on Saturday, when the unions instructed the men to return to work. A message to that effect was therefore telephoned to Mr. A. L. C. Fell, the Chief Officer. Meanwhile, the L.C.C. had issued a notice that no man of military age would be re-engaged, and some trouble arose on Sunday and Monday in regard to this. The result was that the union called out the men again, but the L.C.C., whilst not modifying its attitude, has agreed to consider reasons put forward by any man of military age for not joining the Army. The men have also returned on the Metropolitan electric tramway system, it is said without restrictions as to age.

"ELECTRICAL ENGINEERING" TRADE SECTION

ELECTRIC MOTOR CAR ACCESSORIES

A COMPREHENSIVE catalogue of electrical accessories for motor-cars has been issued by the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.). With the almost universal adoption of electric lighting and other auxiliary services on motor-cars, the matter is

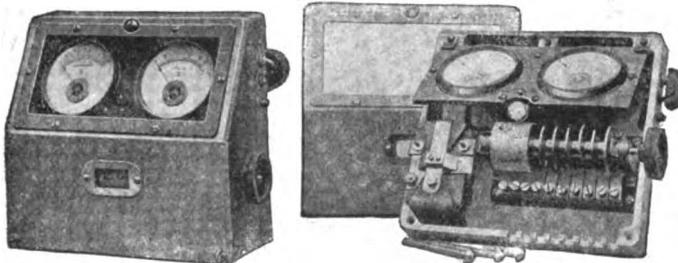


FIG. 1.—CAR-LIGHTING SWITCHBOARD, WITH INSTRUMENTS, TAIL LAMP TELL-TALE, AND AUTOMATIC CUT-OUT.

becoming one of increasing importance. Two very neat forms of lighting switchboard, with and without instruments, are illustrated here, together with a special form of twin armoured cable for car wiring. The larger board is provided with a tell-tale lamp within the case, which indicates whether the tail lamp is alight, and at the same time furnishes enough



FIG. 2.—SWITCHBOARD WITH CHARGING INDICATOR AND AUTOMATIC CUT-OUT COMPLETE.



FIG. 3.—TWO-CONDUCTOR ARMoured CABLE FOR AUTOMOBILE USE.

light to read the instruments. Several forms of car-lighting and ignition batteries are listed, and other articles dealt with include ammeters, voltmeters, lamps, horns, fittings for interior lighting, hand lamps, sparking plugs, switches, charging boards, cable connectors, cables, and other accessories.

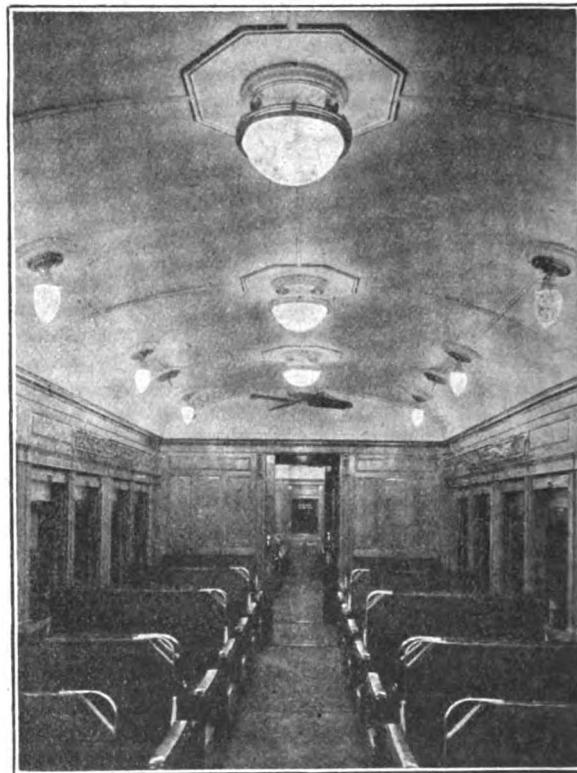
ELECTRICAL TIDE GAUGE

MESSRS. GENT & CO., Ltd. (Faraday Works, Leicester), recently completed an interesting application of their water-level indicating apparatus for the purpose of registering the state of tide. The apparatus is being used in conjunction with certain dredging operations now being undertaken by Messrs. Topham, Jones & Railton, and its purpose is to indicate to their vessels the height of the tide during the night. The apparatus, which is fixed on a timber dolphin about half a mile from the shore, consists of a 25-volt Walker Horrocks automatic electric lighting plant driven by a petrol engine, and having accumulators of 240 ampere-hour capacity for supplying the current to the five different coloured anchor type lamps. The mechanism, which is operated by a float fixed in a standpipe under the dolphin, consists of a number of switches operated by a lever which is geared to a chain connected with the float, and as the tide rises and falls, every 6-in. difference in level causes the switches to operate and cut in different groups of lamps in accordance with a pre-arranged code. Different combinations of red, green, and white lamps indicate a difference in level from zero to 19 ft. 6 in., and with a spring tide the change of lights takes place approximately every five minutes. The plant is entirely automatic in working, being self-starting, self-regulating, and

self-stopping, occasional oiling and replenishing of fuel only being required. If the engine fails to start, a warning is given by a red light at the side of the engine-house, but the cells will supply light for about four days after this warning has been given. A time switch is used in the circuit to cut off the current during the daytime. The view from the shore at night of the regular changes of colours in the group of lamps indicating the varying depth of the tide proves very interesting to watch.

RAILWAY CARRIAGE LIGHTING

AN increasing amount of attention is being paid to the subject of the correct illumination of railway carriages, and a good example of up-to-date practice is shown in the illustration. This railway carriage is one of a large number built by the Metropolitan Carriage Wagon & Finance Co., Ltd., at Saltley, Birmingham, for the Central Argentine Railway. The overall dimensions of the carriage are approximately 66 ft. by 9 ft. It is divided into two compartments, each 25 ft. by 9 ft., and both compartments are installed with four 12-in. Holophane



CARRIAGE LIGHTED THROUGH HOLOPHANE GLASSWARE.

reflectors (each equipped with two 40-watt lamps) down the centre of the coach, whilst on either side there are four Holophane "Pines" with 40-watt lamps. The energy provided in this case is very liberal, enabling an illumination intensity of 6 foot-candles to be obtained uniformly over the whole reading plane. Notwithstanding that the illumination intensity is so high, excellent diffusion and evenness are obtained from the use of the Holophane glassware, whilst glare and shadows are obviated. The carriage has a particularly lively and pleasing effect when illuminated, and the handsome furnishings are shown up to advantage.

The Teaching of Electric-light Switching.—A. P. Lundberg & Sons have brought out a new edition of their booklet on the teaching of electric-light switching. This aims at extending and systematising of this important, but until lately somewhat ignored, branch of electrical engineering, and its utility is vouched for by opinions of some teachers in technical schools reprinted at the end.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Derby.—The L.G.B. has sanctioned a loan of £25,090 for electrical extensions.

Northampton.—The Northampton Electric Light & Power Co. propose to construct a new power station at Far Cotton.

Redditch.—H.T. three-phase switchboard. Consulting Engineers, Handcock & Dykes, 11 Victoria Street, S.W. June 14th.

South Africa.—An expenditure of £20,000 on the East London electrical undertaking is contemplated.

Stalybridge Joint Board.—A loan of £4,000 for transformers and mains is to be applied for.

Wiring

Dundee.—The Corporation's premises in East Dock Street are to be lighted by electricity.

Eccles.—Electric lighting of Anson Street School, Winton. Town Clerk. June 19th.

Porth.—Electric lighting and fitting of police court. Clerk, Glamorgan County Hall, Cardiff.

West Ham.—Electrical installation at Knox Road School. Architect, W. Jacques, 2 Fen Court, Fenchurch Street, E.C. June 14th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Altringham.—New school.

Ashton-under-Lyne.—New school.

Colne.—New hospital.

Deal.—Extensions to Victoria Hospital.

Dumfermline.—Cinematograph theatre, Queen Anne Street.

D. Young, 118 Dewar Street.

Leeds.—Regent Picture House. Architect, F. Mitchell, 9 Upper Fountaine Street.

London.—Branch post office, Threadneedle Street, H.M. Office of Works, Storey's Gate, S.W.

Manchester.—Reconstruction of cotton warehouse after fire (£70,000). Faulkners, Knott Mill.

Stirling.—Sanatorium (£25,000).

Swindon.—Tuberculosis hospital.

Miscellaneous

Dublin.—Twelve months' supply of oils for Electricity Department. Town Clerk. June 10th.

Glasgow.—Twelve months' supply of electrical stores for the Clyde Navigation. General Manager, 16 Robertson Street.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Abercynon.—The Council has accepted the tender of the Electric Construction Co. for transformers and switchgear at £614, and that of the British Insulated & Helsby Cables, Ltd., for E.H.T. cable, L.T. mains, and public lighting at £2,099 19s.

Dundee.—Contracts have been placed with W. H. Allen, Son & Co., and John Wilson (London), Ltd., for pumps and cast-iron piping respectively, for the extensions at Carolina Port power-house.

East Ham.—A contract has been placed with the British Thomson-Houston Co. for a twelve months' supply of continuous-current meters.

Falkirk.—A contract has been placed with Venner & Co. for a twelve months' supply of Chamberlain & Hookham meters.

Glasgow.—Contracts have been placed with the B.T.-H. Co., Ferranti, Ltd., and Chamberlain & Hookham for twelve months' supply of meters.

Hendon.—The Board of Guardians has accepted the tender of the Hendon Electric Supply Co. at £339 11s. for an electrical installation at the workhouse.

Hornsey.—The Council have placed a contract with the British Thomson-Houston Co. for a twelve months' supply of D.C. ampere-hour meters.

London: *Hackney.*—Hitherto Chamberlain & Hookham and Ferranti meters only have been used in Hackney, but about twelve months ago 60 meters were supplied by the Electrical Apparatus Co., and gave good results. The prices of the latter are considerably below those previously used, and the difference in price is very marked in the case of the smaller meters. The Electricity Committee now recommends that a "sole-use" contract be entered into with the Electrical Apparatus Co. for meters up to 25-amperes capacity for one year, the prices being:—1·5 and 3 amperes, £1 each; 5 amperes, £1 4s.; 10 amperes, £1 7s.; 15 amperes, £1 11s.; 25 amperes, £1 13s.

Hammersmith.—On p. 201 of our issue for May 6th we referred to a report by the Electricity Committee, in which it was stated that Messrs. Johnson & Phillips, whose tender had recently been accepted for box-frames, covers, &c., had asked the Council to release them owing to Government work. Messrs. W. Lucy & Co. were asked to accept the contract, but they have intimated they will require an additional 7½ per cent. on the prices originally tendered. The Committee therefore recommend the Council to purchase as required in the open market, and not to accept any tender.

Manchester.—The following tenders have been accepted:—British Westinghouse Co., three 1,200-kw. static transformers; British Insulated & Helsby Cables, Ltd., cable; R. Seddon & Sons, electric wiring, &c., at New Islington School Clinic.

Rugby.—The tender of the Macintosh Cable Co. has been accepted for cable.

Amongst a large number of orders recently completed, Messrs. E. Bennis & Co. have supplied four sprinkler stokers and compressed-air furnaces for 8 ft. diameter Lancashire boilers, as well as two pairs of chain-grates, 6 ft. 6 in. wide by 11 ft. long, to the Rotherham Electricity Works. The firm has also re-linked two chain-grates with the Bennis patent links at the Liverpool Electricity Works.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Although the Metal Exchange is not open for business in the ordinary course, Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the following may be taken as the official quotation for electrolytic copper bars, viz., £89 10s. to £90 10s. (last week, £86 10s. to £87 10s.).

Australian Trade.—We are requested to state that Mr. O. L. Remington, Manager of Wm. McLean & Co. (Melbourne), will be visiting London about the middle of June, making the Savoy Hotel his headquarters, and will be glad to get into touch with manufacturers of manufacturing machines generally, including wire-drawing, braiding, taping and rubber covering, and cotton-covering machines.

Advance in Prices.—Owing to the increase in the cost of aniline dyes, Siemens Brothers Dynamo Works, Ltd. (Supplies Department, 38 and 39 Upper Thames Street, E.C.), have found it necessary to advance the price of their lamp-colouring varnishes by 20 per cent. The price of Siemens lamp obscurer, which is an etching fluid, is also advanced 20 per cent. They have also found it necessary to advance their list prices of fittings and glassware by 10 per cent.

Companies Struck Off Register.—The names of the following have been struck off the Register of Joint Stock Companies:—County Electric Traction Co.; Electric Batteries & Carbons; Leeds Electric Co.; Southwold Electricity Works; Witney Electric Supply Co.

Bankruptcy.—A first and final dividend of 9½d. in the £ is to be paid in the bankruptcy of H. J. Godfrey, Electrical Engineer, lately carrying on business at 188 Balham High Road, London. This amount is payable on June 11th at the Official Receiver's Offices, 132 York Road, Westminster Bridge Road, S.E.

APPOINTMENTS AND PERSONAL NOTES

Mr. G. Marconi, who was in America when Italy declared war on Austria, is now on his way back to Italy to take charge of the Government wireless telegraph organisation.

The position of Borough Electrical Engineer at West Hartlepool is vacant owing to the death of Mr. H. F. Friederichs. Commencing salary, £400 per annum. Applications to Town Clerk by June 9th.

LOCAL NOTES

Birmingham: Electricity Accounts.—The revenue of the electricity undertaking for the year to March 31st was £379,625, compared with £346,561 in the previous twelve months. After meeting capital charges there is a balance of £60,385, from which the Committee has transferred £25,000 to renewals and special expenditure account, and the balance it is proposed to transfer to the credit of the Borough rate. This is £10,250 more than was contributed in the previous year.

Bury: Electricity Profits.—There was a net profit of £2,038 upon the working of the electricity undertaking last year. Of this, £1,000 have been transferred to relief of rates and the balance to reserve.

Derby: Increase in Electricity Charges.—In announcing an increase of 10 per cent. on the present charge for electricity, the Electric Lighting Committee point out that even this will not cover the extra expenditure involved by present circumstances on the working of the undertaking.

Dundee: Electricity Revenue.—The revenue of the Electricity Department for the year to March 31st amounted to £65,529, against £58,790 in the previous twelve months. After meeting capital charges there is a net balance of £2,835, which is carried forward.

Glasgow: Financial Control of Electricity Department.—As from June 1st Mr. James Fleming, Treasurer to the Electricity and Gas Departments, is retiring. The Corporation has agreed that in future the finances of the Electricity Department shall be placed under the control of Mr. W. W. Lackie, the Chief Engineer and Manager.

Hull: Electricity Accounts.—The electricity accounts for the year to March 31st show a net profit of £2,374, which has been carried to reserve. The Department has contributed £1,109 to employees who have enlisted, whilst £269 has been spent upon guarding works, both sums, of course, being met out of revenue.

Kilmarnock: Plant Extensions.—The installation of a new 1,500-kw. 3,000/3,300-volt 50-cycle three-phase turbo-alternator has just been completed. This has necessitated an extension to the boiler-house and the addition of another B. & W. boiler. The new plant also includes two rotary converters. The turbo-alternator and switchboard have been provided by the British Thomson-Houston Co., and the converters by Bruce Peebles & Co.

Leeds: Electricity Estimates Exceeded.—The estimated profit on the electricity undertaking for the year to March 31st, 1915, has been exceeded by £7,700.

London: Electricity Charges.—The Associated Municipal Electrical Engineers of Greater London has sent a circular to the electricity undertakings represented in its membership, pointing out that careful consideration has been given to the increased cost of generating electricity owing to the high price of coal, &c., but it is urged that the charge to the consumer should not be increased except where imperatively necessary. In such cases it is recommended that the increase should not exceed 10 per cent.

Salford: Electricity Accounts.—The accounts of the electricity undertaking for the year to March 31st, 1915, show a net profit of £8,406, compared with £3,629 in the preceding twelve months. The total number of units sold increased by one million. The whole of the available balance has been placed to the credit of depreciation and renewals fund. For the current year the Electricity Committee has notified the Finance Committee of its anticipation to hand over £3,500 to relief of rates.

Stoke-on-Trent: Meter-reading Error.—The Chairman of the Electricity Committee reports that certain mistakes by

meter-readers have resulted in the amounts due from some consumers being lower by about £1,000 than should be. The errors are explained by the fact that the meters in question are of a complicated type. The firms concerned have agreed to pay this amount. This incident recalls a similar one on a London supply company's mains, where the amount involved was considerably more than in the present case, and a legal action was necessary to establish the supply authority's right to the payment of the amount undercharged.

COMPANIES' DIVIDENDS, REPORTS,
MEETINGS, &c.

West London & Provincial Electric Supply Co.—This Company, which controls the Chiswick Electricity Supply Corporation and the Aberystwyth Electricity Supply Co., reports that at Aberystwyth the conditions last year showed more or less a normal improvement, owing to the town having a large number of soldiers billeted. The result is that more current than usual was used at the non-season period. An additional Diesel engine set is being installed. At Chiswick the Company was affected more or less in the same way as most of the London companies, the revenue being slightly less than in the previous twelve months. The 10 per cent. increase decided upon by the London companies has also been put into force at Chiswick.

Callender's Cable & Construction Co.—At the annual meeting last week the report and accounts given in our issue for May 20th, p. 222, were adopted. Mr. T. O. Callender, who presided in the absence through illness of the Chairman, Sir Fortescue Flannery, M.P., pointed out that while the result of the year's trading was extremely satisfactory, it had only been arrived at after a great deal of hard work and worry, owing to the disorganisation of business consequent upon the war. The amount of contract work had considerably decreased in consequence of the Treasury ban on capital expenditure by local authorities, and the large telephone contracts of the Post Office had, for a like reason, been suspended. On the other hand, the Company's large engineering business had been taken advantage of in connection with work for the army and navy, especially by the latter, with which the Company had always been in close touch.

Shanghai Electric Construction Co.—A dividend of 6 per cent. is recommended on the ordinary shares for the past year, and it is noteworthy that the loss by exchange on coinage during the year was no less than £28,038, equal to 8½ per cent. on the capital. The dividend now recommended is 1 per cent. less than in the previous year.

Electric Construction Co.—The report and accounts given on page 222 of our issue for May 20th were adopted at the annual meeting last week. Mr. P. E. Beachcroft, who was in the chair, called attention to the fact that during the past five years the gross profit has increased by more than 50 per cent. No less than 30 per cent. of the company's workmen have joined the forces with a consequent effect upon the output. The receipt of Government orders, said the chairman, did not necessarily mean larger profits than those accruing from ordinary business. The amount of profit available was sufficient to enable a larger dividend than 6 per cent. to be recommended, but the directors limited themselves to this amount, having regard to the uncertainties of the future.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—There was a net profit last year, including the amount brought forward, of £14,399. It is proposed to transfer £4,500 to reserve, to pay a 3 per cent. dividend on the ordinary shares, and to carry forward £899.

Cornwall Electric Power Co.—An offer of £60,000 5 per cent. debenture stock at 95 is being made to the shareholders. The proceeds of the issue, after payment of outstanding accounts for plant, &c., will provide about £21,000, which is necessary for new plant.

South Metropolitan Electric Light & Power Co.—An issue of £25,000 4½ per cent. first mortgage debenture stock at 95 is being made, and also £25,000 6 per cent. £1 cumulative second preference shares at par.



ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING.

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SUMMARY

SOME details are given of a large single-phase alternator of Swedish manufacture (p. 242).

THE switchgear required for balancer panels is discussed in our Questions and Answers Columns (p. 243).

FURTHER applications to join the Electrical Emergency Service are still welcome (p. 244).

AT the last meeting of the Development Committee of the I.M.E.A., reports were received from sub-committees showing progress that has been made, more particularly with the preparation of a publicity scheme (p. 244).

A PROPOSAL by Mr. R. Steylaers with regard to future British electrical trade with Belgium is referred to (p. 244).

AMONG the subjects of specifications published by the Patent Office last Thursday were petrol electric transmission, protection of alternators, circuit breakers, conduit fittings, and electromagnetic switches (p. 245).

MR. W. SLINGO, Engineer-in-Chief to the General Post Office, has been knighted (p. 246).

THE names of successful overseas competitors in Lundberg's Electric Light Switching Competition are announced (p. 246).

A CURIOUS point regarding the position of the Adnil Electric Co. has been argued in the courts (p. 246).

NEW forms of alternator field regulator and multiple switch starter are described and illustrated (pp. 246-7).

CABLES extensions are contemplated at Stretford and Turton; a loan of £3,391 has been sanctioned at Batley; a 50-kw. steam-driven dynamo is required for the Cottage Homes at Manchester; two water-tube boilers and mechanical stokers at Wigan; boosters, switch-

board panel and instruments at Wellington (N.Z.), and meters at Christchurch (N.Z.) (p. 248).

THE Dover Corporation has postponed its extension scheme owing to difficulties with the L.G.B.—The St. Pancras Borough Council and the L.C.C. are still unable to come to a decision with regard to the reduction of certain outstanding loan periods.—West Bromwich has decided to increase its electricity charges by 20 per cent.—The Dublin Corporation has finally decided on an increase of ½d. and ¼d. per unit for lighting and power respectively (p. 249).

Death from a 170-volt Shock.—Last week the inquest upon the death of a boy seven years old, killed by an electric shock on Volk's Electric Railway, Brighton, was concluded. On this railway, current is supplied to the trains by a live rail at 170 volts, with earth return. In view of the low pressure, the live rail is not protected in any way at level crossings, and, in fact, it is by no means unusual for children to amuse themselves taking shocks from it. A post-mortem examination showed that the boy was in a condition of status lymphaticus, which would make him very susceptible to electric shock. He had been paddling all day, his feet were bare, and his skin as well as his clothes was fairly well soaked with salt water. Apparently, instead of crossing the railway at the level crossing, he crawled up the piles on to the line, got a preliminary shock by touching the live rail and the earth return, which knocked him over, and he fell with his chin on the live rail and with his body, wearing a soaked jersey, across the rail. A burn on the chin showed that he was probably in this position for some time before assistance came. Evidence was given by Mr. J. Christie, Engineer and Manager, Brighton Electricity Works, and Mr. J. H. Rider, who both suggested that it would be well in future to put a strong wood guard on both sides of the live rail at level crossings, more or less on the lines of the guards adopted on the Underground Railways of London. The jury found that there was no culpable negligence on the part of anyone, but added a rider suggesting that the line should be fenced off with definite level crossings not more than 100 yards apart, and that notices warning people from crossing the line elsewhere should be put up.

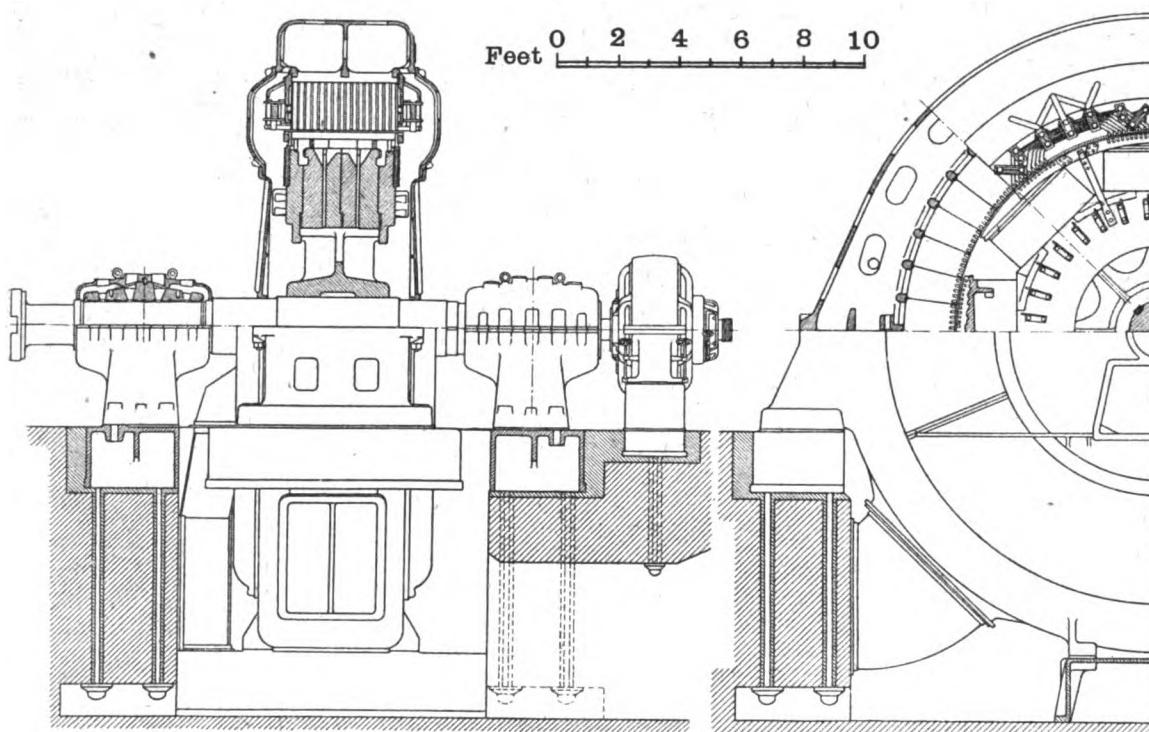
Coal Prices.—Mr. Runciman stated in the House of Commons on Tuesday that an understanding had been arrived at with the principal London coal merchants for a limitation of profits, but that negotiations with Midland coal-owners, with a view to fixing prices at the pit-head on the basis of last year's prices, had so far not resulted in a definite arrangement.

Arrangements for the Week.—*Thursday, June 17th.*—Incorporated Municipal Electrical Association, Annual Meeting, I.E.E., Victoria Embankment. Discussion on report by A. S. Blackman (Sunderland) and T. Roles (Bradford) on "The Practical Result of the Point Five Tariff," 10 a.m. Report by F. Ayton (Ipswich) on "The Use of Electric Vehicles in Municipal Service," 2.30 p.m. Parade of Electric Vehicles, 5 p.m. "Point Fives," Trinity House, Oxford Street, W., 7 p.m.
Friday, June 18th.—Incorporated Municipal Electrical Association, I.E.E., Victoria Embankment, Annual General Meeting, 10 a.m.

A LARGE SINGLE-PHASE ALTERNATOR

ONE of the generators in the Porjus water-power station from which current is derived for the working of the Kiruna-Riksgränsen single-phase railway in the north of Sweden, which is stated to be the largest single-phase generator yet built, is described in the *Elektrotechnische Zeitschrift* for May 13th. The machine in question, however, is not of German manufacture, but was constructed by the Swedish firm, Allmänna Svenska Elektriska Aktiebolaget, of Westerås. The alternator is rated for a normal continuous output of 6,250 k.v.a. and a maximum overload for short periods of 10,000 k.v.a., and is of the horizontal-shaft type direct coupled to its turbine, and running at 225 r.p.m. The machine is compounded on the Danielson system by means of a rotary converter and booster acting on the exciter field, so that the no-load voltage is 3,400 volts and that of the full overload 4,150 volts at 15 cycles per second. At the normal voltage at no-load the excitation required is 6.5 kw., but at 10,000 k.v.a. at 0.8 power factor the figure rises to 55 kw. The machine, in view of the speed and frequency, only has eight poles, which are circular in section and necessarily of large diameter, so that ventilating ducts are required for their adequate cooling; cooling fins are

The general construction of the machine is shown in the figure. The stator is of massive construction, and the end connections are securely anchored. The bars forming the winding are split into two separate conductors to diminish eddy currents, and mica slot insulation is employed. The rotor departs more from ordinary design than the stator on account of the high speed and low number of poles to the size of the machine. The high peripheral speed renders steel exclusively necessary, and the rotor body is composed of steel rings built up on a Siemens-Martin steel hub. Each ring alone weighs about 10 tons. These have the pole projections cast on. This construction has been employed by the manufacturers with success in other large machines, such as the 10,000-k.v.a. alternators at Trollhättan and the still larger 17,000-k.v.a. machines for Rjukan, and the Swedish steel works make a speciality of large steel castings of this nature. The pole-pieces are not affixed by screws in the ordinary way, but a form of bayonet joint is employed of greater strength and reliability. The pole laminations are of thick core plate dovetailed in, and carry the damping winding in slots, and a ventilation space is left between the end rings and the pole-plates. The machine is entirely enclosed, and a radial ventilating current of air is produced by fan-blades on the rotor. The air is drawn in and expelled through a duct



SECTIONAL ELEVATIONS SHOWING DETAILS OF 6,500-K.V.A. SINGLE-PHASE ALTERNATOR.

also provided on the winding. A damping winding is provided of the same conductor section and in the same number of slots as the armature winding, connected to two stout copper rings on either side. The pole-shoes are laminated, and in order to avoid superposed high harmonics on the voltage wave-form, the damping bars are staggered. The effect of the high time constant of the magnetic circuit of the field system in causing the alterations of flux to lag behind changes of excitation is very appreciable, and has considerable effect on the action of the compounding system, and the presence of a damping winding tends to enhance this lag, but its effect in this direction is less than if it were placed, as is sometimes done, outside the field coils owing to the influence of magnetic leakage, and tests show that the presence of the damping winding has not raised the time constant (*i.e.*, the time taken for the full exciting current to reach its full value) more than 30 per cent. above its calculated value of 12 seconds. This sluggishness in flux change not only affects the voltage regulation of the machine on sudden changes of load, but raises the possible momentary short-circuit current to a very high value. In view of these facts a special form of quick-acting voltage regulator is employed, which applies at first a very much higher change in excitation than is required for the permanent change of flux required, while permitting the compounding arrangement to take charge of the permanent value of the field.

of some considerable length, as the turbine-room is underground. The total weight of the machine is about 200 tons, of which 85 tons are accounted for by the rotor. The following efficiencies are taken from a curve in the article referred to:— $\frac{1}{2}$ load, 92.6; full load, 95.1; and 50 per cent. overload, 96.3 per cent. The machine has withstood short-circuit tests without damage, although the maximum current attained was fifteen times the normal.

The "Central."—The May issue of the magazine of the old students of the City and Guilds (Engineering College), South Kensington, contains, among other interesting contributions, some notes by Prof. Howe on the British Association meeting in Australia. Some notes also describe the uses made by the military authorities of the college premises at the outbreak of war, when a considerable force was quartered in some of the buildings. Subjects of technical articles include applications of the mercury arc, Diesel engine troubles, and the future possibilities of domestic electricity. An account is also given of an expedition to Sweden last summer to observe the solar eclipse, and the issue concludes with a lengthy Roll of Honour, which shows how well "Old Centralians" have responded to their country's call.

Research Scholarships.—The Manchester Municipal School of Technology offer one research scholarship of £60, three of £75, and six of £50. Particulars can be obtained from the Registrar, and entries must be sent in by June 21st, 1915.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,446.

A manufacturer sent a shunt motor and starter, both in perfect order and carefully inspected and tested, to a distant job. He received a telegram from his customer stating that the motor ran enormously above its rated speed. What is the most probable reason that the manufacturer would suggest for this?

(Replies must be received not later than first post, Thursday, June 17th.)

ANSWERS TO No. 1,446.

State briefly and concisely what switchgear is necessary for a balancer panel for a 3-wire supply system, and explain its connections and the function of each piece of apparatus.

The first award (10s.) is given to "Y. Z." for the following reply:—

The switchgear for a three-wire balancer panel is shown in its very simplest form in the diagram (Fig. 1). The various items are as follows: F_1 , Sw_1 , and F_2 , Sw_2 , are a double-pole switch and fuse, which may obviously be replaced completely by a double-pole overload-type circuit-breaker. A_1 and A_2 , are centre zero ammeters, one for each side of the balancer.

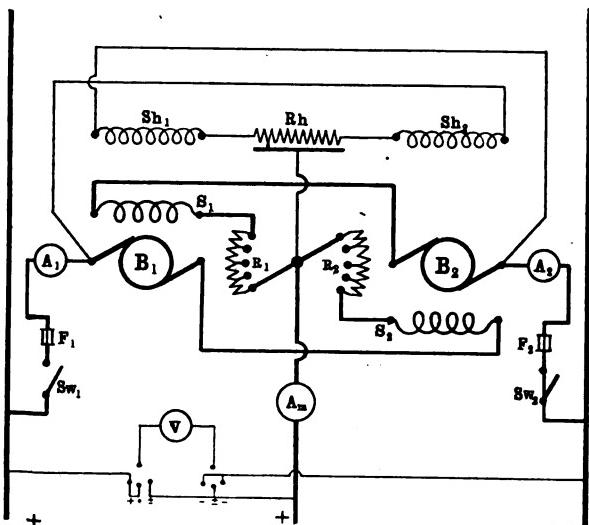


FIG. 1.

These two ammeters may, if desired, be replaced by the single ammeter Am , also centre zero type, which shows the current in the middle wire. The current in Am is at any moment the numerical sum of the currents in A_1 and A_2 , less the shunt current. R_1 and R_2 is the starting arrangement for the balancer. The set is started up exactly as if it were two motors coupled

together mechanically and connected electrically one to each side of the three-wire system. When the double-pole switch is closed, current can flow in each armature B_1 and B_2 at once, as the common lever arm of the two starting resistances is arranged never to break contact with the resistances; i.e., there is no "off" position of this switch. If thought desirable in any case, the starter may be provided with a no-volt release consisting of a hold-on bobbin connected across the mains. R_h is a shunt regulating resistance arranged to cut resistance out of one field circuit at the same time as it cuts resistance into the other. If desired, this may be replaced by two independent regulators; and, further, in the case of a balancer properly designed with compound winding to give a fixed voltage on each side of the system under all possible circumstances within its specified range of power, a shunt regulator becomes unnecessary altogether. V is a voltmeter with a three-way double-pole selector switch, connected so that the instrument may read the volts between + and - or + and ± or ± and -.

The above is all the external apparatus required. The balancer is started by closing the double-pole switch, and cutting out R_1 and R_2 simultaneously. It will be noted that the arrangement shown has the advantage of providing a discharge circuit for the shunt field winding of each machine through the armatures, thus dispensing with the necessity of a separate shunt breaking switch and discharge resistance. Should the set not be automatically self-regulating, the resistance R_h (or the equivalent pair of regulators already mentioned) will need re-adjustment from time to time. The actual disposal of the various pieces of apparatus on a panel will of course be determined by the circumstances of each case, e.g., what room and what shape of space is available; whether the panel is self-contained or forms part of a main switchboard, and the like.

A word in conclusion may be said about the internal con-

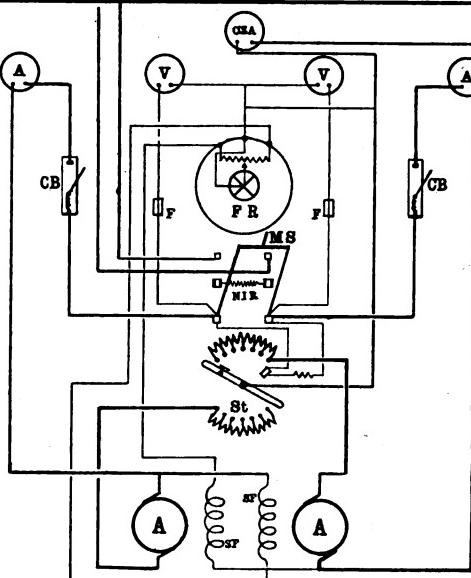


FIG. 2.

nnections of the balancer. This consists, as is well known, of two machines forming practically an automatically reversible motor-generator. The series windings S_1 and S_2 are so connected that they assist the shunt windings Sh_1 and Sh_2 in producing flux when the machine acts as a generator, and therefore they act against the shunts when the machine acts as a motor. The series windings are shown crossed, i.e., the generator current excites the motor series, and vice versa. This precaution is taken because if the motor excited its own shunt, a heavy short-circuit or overload might cause too much weakening of the motor field, resulting in a flash-over at the brushes. With the connections shown in the diagram, however, the generator field is abnormally strengthened in such a case, which causes the desired result to be obtained with more rapidity than would otherwise be the case. The shunt windings are also shown crossed, even with a compound wound machine, because here too the momentary drop of volts on the overloaded side causes the motor to run away a little when the shunts are crossed, while the generator field is strengthened, causing the apparatus to be more sensitive than if the shunts were not crossed. Hence crossing the shunts gives sensitivity, and crossing the series gives stability. Sometimes the series windings are coupled in the middle wire itself, and carry the full out-of-balance current. This arrangement is also quite satisfactory, but leads to less quick action than that shown in the diagram. If heavy overloads are anticipated, interpoles should be provided. These are not shown in the diagram, but they would be coupled up so that the interpole winding of each machine carried the current of the armature of the same machine, for obvious and well-

known reasons. The two armatures are denoted by B_1 and B_2 , as already stated.

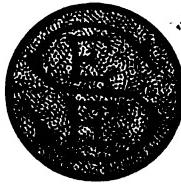
The second award (5s.) is made to "J. E. R. R." who writes as follows:—

The diagram in Fig. 2 shows the essential switchgear for a three-wire balancer panel. It contains the following gear: main switch (*M.S.*) fitted with quick break blades and special contacts so arranged that, should the main switch be pulled out with the starter on the dead notch, a non-inductive resistance (*N.I.R.*) is first put in parallel with the field windings before the circuit is broken. This, of course, prevents breakdown through inductive kicks, as it is not possible with balancer sets to wire the fields from the first notch of the starter resistance as is usually done in the case of single machines. Two circuit-breakers (*C.B.*) or fuses, the former being preferable. Two ammeters (*A.A.*) reading the current taken by each machine and two voltmeters (*V.V.*) reading the volts across each outer and neutral with protective fuses in series. A central zero ammeter (*C.Z.A.*) reading the current in the neutral wire or the out-of-balance current. A starter (*St.*) for starting the set-up by inserting and cutting out resistance in series with each armature, and, though this is really not essential, but is advisable for protective purposes, a no-volt coil and series resistance tapped across the mains. A combined field regulator (*F.R.*), the centre terminal of which is coupled to the contact arm, and the other two to the ends of the resistance, so that when the regulator handle is turned, resistance is put in one field winding and taken out of the other, according to the load.

The fields of the machines are shown cross-connected to make the set approximately self-regulating. It will be seen that if a load comes on, say, between positive and neutral, and tending to lower the voltage on that side, it weakens the field of the machine operating on the other side, negative to neutral tending to speed the set up and increase the volts of the machine operating on that side which has received the load. Shunt wound machines only have been shown, but the addition of a series winding does not call for any further switchgear except in the cases of special sets, which sometimes are fitted with diverter resistances and short-circuiting switches across their series windings. There are two points relating to the switch-gear that it is well to keep in mind. In the first place, the resistance coils of the field regulator should be amply designed and carefully watched, as an open circuit occurring in any coil may lead to the wrecking of the set. Secondly, the writer has found it convenient to put a switch in the neutral wire or make one of the terminals on the central zero ammeter easily removable so as to be able to disconnect the set quickly from earth for testing purposes.

THE ELECTRICAL EMERGENCY SERVICE

WE want every electrical engineer in London who will give at least either four hours a day of his spare time, or four hours on alternate nights, to become enrolled in the Electrical Emergency Service.



This Service is filling the gaps caused by switchboard attendants in London electricity works and substations who are leaving, or have left, to join the Army and to make munitions of war. A badge, of which the annexed sketch is a facsimile, is issued to members of the Service on taking up their duties.

We have many names on our register already, but not enough to meet the emergency demand which is certain to occur during the next few weeks in view of Lord Kitchener's appeal for 300,000 more men.

Moreover, it is the good men we most want: for instance, men over military age who have filled or are filling good positions in the electrical profession, who have arrived at the stage when they might normally take things a little easier after the strenuous life which this profession always imposes on its devotees, but who are willing now to defer their rest a little longer in view of the national emergency.

Applications for enrolment, on the form published in our last issue (p. vii), should be sent to the Editor of ELECTRICAL ENGINEERING, 203 Temple Chambers, London, E.C., who will be pleased to reply to any inquiries for further information, and from whom also further application forms may be obtained.

THE DEVELOPMENT COMMITTEE OF THE I.M.E.A.

AT a meeting on Friday, April 16th, a report was received from the Publicity Sub-Committee on the work done with regard to a preparatory scheme for the production of printed matter on a co-operative basis. The Sub-Committee also reported that Mr. Dunlop, on behalf of the British Electrical and Allied Manufacturers' Association Council, had very kindly offered the use of offices and clerical assistance in connection with the routine work of purchase and distribution of such printed matter, at least during the early stages of the Sub-Committee's work. The Committee expressed their appreciation of this offer. It was resolved that Mr. Courtenay, of the General Electric Company, should act on the Publicity Sub-Committee in place of Mr. C. Palmer, at present on active service.

A report was also received from the Electrical Installations Sub-Committee, and considered. A report was also received from the Domestic Appliances Sub-Committee, outlining a preliminary scheme for certain technical investigations, which the Committee hope to put in hand at an early date. The Committee recommended the inclusion of Mr. Shaw, of Worcester, and Mr. Wilmshurst, of Derby, as members of this Sub-Committee. Also, that from time to time members of manufacturing firms should be co-opted for advice and assistance in regard to specific objects which might be considered helpful to the work of the Development Committee.

In general discussion arising out of the work of the Committee, the point was made that although depletion of staffs arising out of the war, and restrictions placed on borrowing money must, in the nature of things, considerably hamper development work, yet there remained with most undertakings a large amount of new business to be obtained with very little expenditure, and therefore there still existed room for selective canvassing and publicity work, which might be directed to helping manufacturers and traders under the present difficult conditions, if electricity supply were put forward, more particularly in regard to power, on the strength of its real time and labour-saving advantages, and not merely as an improvement on existing conditions. The Secretary reported the correspondence he had had with Mr. Wakeman, Society for Electrical Development, New York, and the Committee instructed him to thank Mr. Wakeman for material sent and offers of assistance and co-operation, which the Committee appreciated very much, and hope that under more favourable conditions in the near future further development in this direction might become possible. The next meeting of the Development Committee will take place on June 16th, 1915, at 2.30 p.m.

ELECTRICAL TRADE WITH BELGIUM AFTER THE WAR

WE have been favoured by a visit from Mr. R. Steylaers, a Belgian electrical engineer now in this country, who is already endeavouring to stimulate British manufacturers into taking an interest in Belgian electrical trade after the war. Mr. Steylaers explained to us the extremely strong position of Germany in Belgian electrical trade before the war; with the exception of a few Belgian manufacturers of electrical machinery, practically the whole of the Belgian trade was in the hands of German firms, principally the A.E.G. and the Siemens-Schuckert groups. The wholesale houses were in many cases, he informs us, more or less under German control, and the country had become accustomed to German methods and designs. There will, it is true, be an enormous amount of electrical work wanted during the re-building of Belgium. Much havoc has been done, and still more will be done before the Germans evacuate the country; Mr. Steylaers even believes that copper lines and cables have already been taken away from all but the more important towns, in view of the shortage of copper for ammunition. It is very early yet to form definite plans when the new conditions are absolutely unknown, and the important question of capitalisation has yet to be considered; but Mr. Steylaers thinks otherwise, and urges an immediate organisation of the means to oust German electrical enterprise from Germany, so as to be ready at the instant the critical moment arrives. Although he has, so far, not found British manufacturers eager to take up the matter at the present time, when their thoughts and activities are all concentrated on the present calls upon their resources, he has received the support of the British Chamber of Commerce, and is, on his own behalf, endeavouring to bring together a number of manufacturers of various electrical specialities to work in connection with a "Union of Belgian Electricians," which he proposes to form, and for which, we understand, he hopes to obtain the necessary capital without calling upon the manufacturers themselves either to provide this or to give inordinately long credit. A meeting, held under the auspices of the London Chamber of Commerce, on May 27th, met with practically no response from manufacturers, but it is proposed to issue invitations for another meeting in a few weeks' time.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 3rd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

10,275/14. Petrol-Electric Transmission. P. BILES. Electric transmission gear for automobiles of the kind in which the engine drives one member (armature or field system) of a dynamo, while the other element is connected mechanically to the shaft driving the road wheels, as well as to one member of a motor, the other member of which is stationary. In this improvement the speed of the driving shaft is varied by shunting more or less of the field of the series motor. (One figure.)

11,436/14. Protection of Alternators. B.T.-H. Co. and F. H. CLOUGH. Method of protecting an alternator, in which the armature conductors of one phase are separated from those of another by an earthed shield connected to an automatic circuit-breaker. (Three figures.)

11,739/14. Third Rail Insulators. B.T.-H. Co. (*G.E. Co., U.S.A.*). A method of supporting under-running and other back conductors, in which the bracket carrying the conductor is clamped between two insulating blocks held by a bolt extending through them. (Four figures.)

11,794/14. Circuit Breakers. D. K. MORRIS and MORRIS and LISTER, LTD. Circuit breakers, in which a blow-out effect is produced by the action of the current itself, without electromagnets. The apparatus is arranged so that the conductors leading to the contact are close together and parallel, or at a very acute angle for a portion of their length. A movable shutter is also provided, which moves into position between the contact surfaces when the circuit is broken. (Four figures.)

18,143/14. Conduit Fittings. M. J. RAILING and J. T. TAYLOR. These fittings have plain side lugs drilled and tapped throughout their thickness, and provided with tangential binding screws, with or without plain or serrated washers. The screw-heads or the washers partially enter openings in the fittings above the lugs, and, when the screws are tightened to clamp the fitting and tube firmly together, scrape or cut the tube to ensure good electrical continuity. (Two figures.)

22,435/14. Electromagnetic Switches. T. E. BARNUM and W. E. DATE. Electromagnetic switches or contactors of the lock-out type controlled by separate and opposing electromagnets energised by a common current, which, if it does not exceed a predetermined value, operates to close the switch; but, if it does exceed that value, prevents the closing of the switch. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: ST. HELENS CABLE & RUBBER Co. and WHITE [Connection boxes] 11,889/14.

DYNAMOS, MOTORS AND TRANSFORMERS: ZIMMERMAN (Commutators) 5,848/15.

ELECTROMETALLURGY AND ELECTROCHEMISTRY: DETTIFOSS POWER Co. and LIDHOLM [Production of cyanamide] 3,545/14.

Heating and Cooking: BERRY [Heating apparatus] 12,551/14.

IGNITION: FORD [Magneton] 12,350/14.

INSTRUMENTS AND METERS: BRITISH INSULATED & HELSBY CABLES, LTD. and WILSON [Meters] 12,386/14; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Induction meters] 15,868/14.

Storage Batteries: COLES [Secondary batteries] 18,092/14.

SWITCHGEAR, FUSES AND FITTINGS: SIMPLEX CONDUITS, LTD. and WATERHOUSE [Conduit fittings] 12,599/14; WHARRAM [Locking and anti-vibrating lamp-holders] 12,906/14; HIGHFIELD and DUDDELL [Protective inductances] 15,356/14.

TELEPHONY AND TELEGRAPHY: LENZ [High-frequency rectifier] 13,374/14; PIERCE [Relays] 15,681/14; WESTERN ELECTRIC Co. (*Woodward* for *W.E. Co., U.S.A.*) [Automatic telephones] 17,004/14; THOMPSON [Telephone-call meters] 21,904/14.

Traction: WILSON [Car lighting] 11,841/14; GENDERS and GENDERS [Electrical locking of carriage doors] 11,987/14; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Self-propelled vehicles] 12,047/14; WRIGHT [Train control] 16,880/14.

MISCELLANEOUS: THEEDAM [Colliery signalling] 12,885/14; THOMAS and STOTT [Primary batteries] 13,095/14; SENCE [Electric hair-brushes] 16,612/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: SIEMENS SCHUCKERTWEBKE GES. [Dynamos] 6,997/15; KETTERING, JUNR. [Engine-starting motors] 7,013/15; MILTON [Generators] 7,374/15.

MISCELLANEOUS: DE CAPITANI [Manufacture of tapes containing parallel electric wires] 7,016/15.

Opposition to Grant of Patents

1,341/14. Combined Starting Motor and Lighting Dynamo. A. H. MIDGLEY and C. A. VANDERVELL. A grant has been allowed in this specification, in spite of opposition. The specification describes a machine with separate commutators and armature windings for use in its two functions. The field windings, which as a self-regulating dynamo leave half the poles unexcited, are re-grouped to give the full number of poles when working as a motor.

The following are the more important Patents that have become void through non-payment of renewal fees.

DISTRIBUTING SYSTEMS, CABLES AND WIRES, INSULATING MATERIALS, &c.: E. WITZENMANN [Flexible cable armouring] 3,917/09.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Control of single-phase motors] 3,884/04; R. D. MERSHON [Dynamo, motor, and transformer windings] 4,175/07.

INCANDESCENT LAMPS: A.E.G. [Centrifugal mercury vacuum pumps] 4,180/07; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Carbon filaments treated with silicon] 4,364/07; H. KUZEL [Shaping metal filaments by loading with a weight when hot] 1,332/09.

INSTRUMENTS AND METERS: COMPAGNIE ANON. CONTINENTALE POUR LA FABRICATION DES COMPTEURS À GAZ ET AUTRES APPAREILS [Induction meters] 8,540/05.

SWITCHGEAR, FUSES AND FITTINGS: L. A. WILLIAMSON [Hand-lamp connections] 3,836/09; SIEMENS BROTHERS & CO., LTD., and B. C. PAYNE [Slow motion for starters, &c.] 4,317/09.

MISCELLANEOUS: M. ARNDT [Electrically-worked engine indicator] 4,252/10.

Procedure Regarding Enemy Applications

Some slight changes have been made in the procedure under the temporary rules issued by the Patent Office in August last. It was then laid down that during the continuance of the war no patent would be sealed and no registration of a trade-mark or design would be granted to subjects of any State at war with his Majesty. The procedure is now defined by the following amended section:—"As regards applications for patents, designs, or trade-marks, no distinction will in the first place be drawn between those made by such subjects and those made by other persons. All proceedings thereunder will be carried on as usual down to and including acceptance; but in the case of applications by such subjects all proceedings thereon subsequent to acceptance (except such proceedings and matters as are mentioned in Section 9 of the Patents and Designs Act, 1907) will be suspended until otherwise directed. The suspension of proceedings upon applications by such subjects will only be recalled or discharged upon proper terms, including, if thought fit, the release of the applicant of the privileges and rights which he would otherwise have under Section 10 of the Patents and Designs Act, 1907." (The Section 9 referred to requires that the acceptance be advertised and the specification open to public inspection. Section 10 provides that on acceptance the application shall have all the rights as if the patent had been sealed, except that he is not entitled to institute proceedings for infringement until the patent has actually been granted.) It is further laid down that opposition by subjects of an enemy State cannot be entertained, and that proceedings in opposition to enemy patents will be suspended until the end of the war. All applications communicated from enemy subjects will be treated as if made directly by the communicator.

ELECTRIC TRACTION NOTES

An agreement is to be entered into between the Marylebone Parish Council and Edison Accumulators, Ltd., whereby the latter will take over the lease of premises occupied by the Jackson Electric Stove Co., adjacent to the generating station. All electric-vehicle charging in the borough is to be carried out through Edison Accumulators, Ltd. (electric vehicles owned by the Council may be excepted), the charge being 1d. or 2d., according to circumstances.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The King has conferred, among the Birthday Honours, a Knighthood upon Mr. W. Slingo, Engineer-in-Chief to the General Post Office. Mr. Slingo, who has been in the Post Office service since 1870, took over the post of Engineer-in-Chief in succession to Major O'Meara in March, 1912. In the early days Mr. Slingo was closely identified with technical training in the Post Office service, and from 1876 to 1898 was identified with the Telegraphic School of Science. In 1898 he was transferred to the Engineering Department, and in 1910 took charge of the inventory work in connection with the transfer of the National Telephone Co.'s business to the Post Office, and subsequently took a leading part in the arbitration proceedings for determining the price to be paid for the Company's undertaking.

Another member of the telegraphic and telephonic profession is included in the Birthday Honours List, viz., Mr. William Maxwell, Director-General, Post and Telegraphs in India, who has been made K.C.I.E.

The Poulsen Wireless Telegraph Co. has been registered with a capital of £450,000. The objects, of course, are to work the Poulsen wireless telegraph system and to adopt an agreement with the British & Overseas Engineering Syndicate. The first directors are Sir Leigh Hoskyns, Bart., A. Davidson, S. F. St. J. Steadman, L. S. Robertson, V. Gandil, and C. Hage (Copenhagen). Registered office, 4 Suffolk Street, Pall Mall East, S.W.

Under the Merchant Shipping (Convention) Act of 1914 all British ships carrying fifty or more persons were to be fitted with a wireless telegraph installation by January 1st, 1916. Similarly, foreign ships entering British ports were required to be provided with wireless equipments, but presumably in view of the present conditions the Board of Trade has decided to take the necessary steps to postpone the coming into operation of these provisions.

ELECTRIC LIGHT SWITCHING COMPETITION

OUR readers will remember the particulars and examination papers of the Switching Competition published in ELECTRICAL ENGINEERING last November. They may also remember that overseas competitors, excepting, of course, those in Ireland, were given till June 1st last to send in their papers. The complete overseas results are as follows:—

Advanced Grade Certificate and Prize.—R. Drilhon, Pau (B.P.), France. (Previously announced.)

Intermediate Grade (Certificates).—H. Christall, London, Ontario, Canada; S. N. Ghosh, Calcutta.

Preliminary Grade (Certificates).—E. H. Asavaid, Bombay; P. N. Chinoy, Bombay; J. J. Irani, Poona; and J. Rustomji, Bombay.

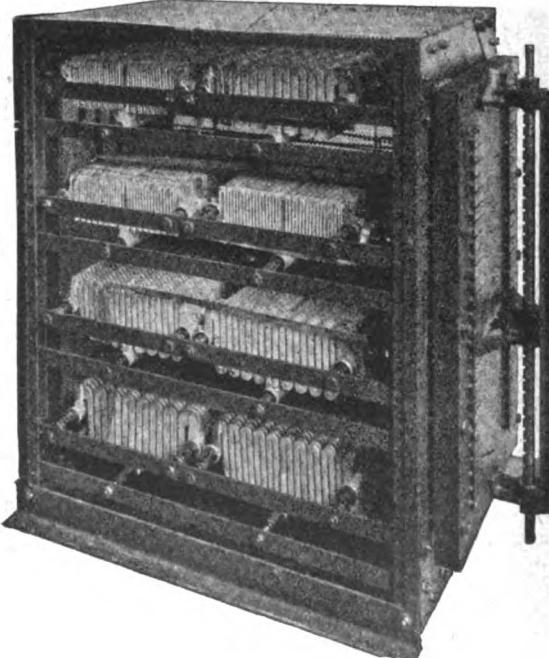
THE ADNIL ELECTRIC CO.'S POSITION

A N interesting case was heard by a Court of Appeal last week, in which the Adnil Electric Co., Ltd., sued the British Traders' Association for payment of monies collected by the latter on behalf of the Company. It appears that before the war the British Traders' Association was requested by the Adnil Electric Co. to collect certain sums of money due from various debtors. After the war broke out, however, the British Traders' Association refused to pay over the sums so collected, on the ground that the Adnil Electric Co., Ltd. (which, of course, is owned by the Bergmann Electrical Works, Berlin), was an alien enemy. The decision, however, in the case of the Continental Tyre Co.

set this point at rest, it being then decided that a company registered in Great Britain, although the share capital might be in the hands of alien enemies, had a right to sue in British courts. Whilst the decision in this case was pending, however, it came to the knowledge of the British Traders' Association that Messrs. Marples & Leach, who were managers of the Adnil Electric Co., were trading on their own account at the same address and with the same staff. This action on the part of Messrs. Marples & Leach, it is now argued, in effect breaks their contract with the Adnil Electric Co., and that consequently Messrs. Marples & Leach, as the representatives of the Adnil Electric Co., could no longer sue on behalf of that Company. The position as put by the British Traders' Association is that Messrs. Marples & Leach, having in effect dissociated themselves from the Adnil Electric Co., and the Adnil Electric Co.'s directors all being resident in Germany, that Company for the present is not in a position to sue, and that therefore the sums collected on behalf of it must remain in the hands of the Association until the end of the war. The argument against paying it over now to Messrs. Marples & Leach is that these gentlemen will use it for the purposes of their own independent business, and that the British Traders' Association might later on, when the Adnil Co. is in a position to sue, be compelled to pay the money again. The Court dismissed the appeal by a majority of two to one, and held that Messrs. Marples & Leach have no authority to sue on behalf of the Adnil Co. Lords Justices Swinfen Eady and Bankes agreed on this, Lord Justice Phillimore dissenting. Much turned upon a letter written in December to the Tyler Apparatus Co., in which Messrs. Marples & Leach stated that they intended to carry on business on their own account, and that no money received by them and in respect of that business would go to the enemy shareholders of the Adnil Co. Counsel for Marples & Leach, in order to establish his case that the agreement with the Adnil Co. had not been broken, said that letter was untrue, and that he could not justify it. The Court, however, held that this letter, in the peculiar circumstances, cancelled the agreement between the Adnil Co. and Marples & Leach, and that therefore the latter had no authority to sue on behalf of the Company. The action also involved other defendants in respect of goods supplied by the Adnil Co.

ALTERNATOR FIELD REGULATORS

FROM time to time we have illustrated several examples of alternator field regulators which are standardised by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, E.C.). These regulators have been of both the circular and the rectangular pattern, with wire, grid, or strip resistances. A further design is shown in the



RECTANGULAR TYPE ALTERNATOR FIELD REGULATOR, WITH GRID RESISTANCES.

accompanying illustration, and was constructed for a large firm of turbo-alternator manufacturers. The "Witton" standard rectangular face-plate construction is used, together with standard grid resistances mounted on a strong angle-iron framework. The strength and compactness of the unit can be readily appreciated.

"WITTON" MULTIPLE SWITCH STARTERS

THE face-plate type of starter serves well for starting small continuous-current motors, but for large motors they are not so suitable on account of the heavier starting currents to be controlled. For this class of work the multiple lever starter has been employed, but this type of starter also has the drawback that breaking the current on the contacts themselves may occur and result in damage through arcing and rapid deterioration of the contacts. The General

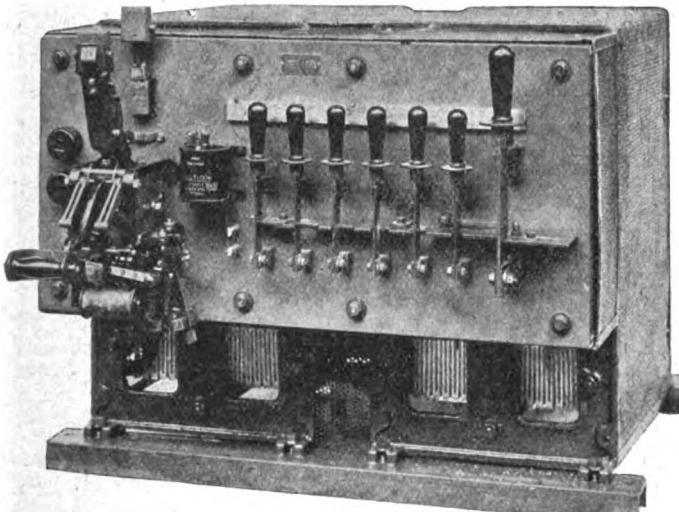


FIG. 1.—“WITTON” MULTIPLE SWITCH STARTER FOR CONTROLLING 100-H.P. C.C. MOTOR.

Electric Co., Ltd. (Witton, and 67 Queen Victoria Street, London, E.C.), has developed a type of starter which avoids this defect. The current is broken by a specially designed circuit-breaker, while the separate knife switch cut out the sections of the resistance in the ordinary way, and are interlocked electrically with the circuit-breaker. In starting up a motor controlled by a “Witton” multiple switch starter, the circuit-breaker is first closed, and the switch cutting out the first step in the resistance is then inserted. But should an attempt be made to insert either the switch that short circuits the resistance or an intermediate switch on the

mechanism and prevents the breaker being closed. Not only is the “Witton” multiple switch starter a mistake-proof device, with a special device for breaking the current, thus preserving the ordinary current carrying contacts from the effects of arcs, but it has been found to be cheaper to construct than other forms of multiple lever starter. Fig. 1 shows a “Witton” multiple switch starter for controlling a 100-h.p. motor, together with the necessary resistance and circuit-breaker, while a view of a similar device controlling a 300-h.p. “Witton” rolling mill motor is shown in Fig. 2. In the latter case it will be observed that the switches are provided with a suitable cover.

CATALOGUES, PAMPHLETS, &c., RECEIVED

LOCKING LAMP-HOLDERS.—A leaflet from Mr. C. H. Jeffcoat (18 Ranelagh Gardens, Hammersmith, W.) gives prices and particulars of the locking lamp-holder described in ELECTRICAL ENGINEERING (Feb. 11th, p. 62).

ELECTRICAL SUPPLIES.—New leaflets from Krupka & Jacoby, Ltd. (39 Victoria Street, S.W.), give particulars of switch lampholders, pocket lamps, and table fans.

ACCESSORIES.—A new list from Donovan & Co. (47 Cornwall Street, Birmingham) gives prices of a wide range of electrical accessories.

HEATING AND COOKING APPARATUS.—A leaflet from Haylock & Haslett (63 Queen Victoria Street, E.C.) calls attention to the “El Grilstovo” electric cooker for grilling, frying, boiling, toasting, &c., to which a small oven can be added for baking and roasting purposes. A breakfast grill and an immersion heater are also described on a postcard being issued by the firm.

MEASURING INSTRUMENTS, &c.—A very conveniently arranged new catalogue of measuring instruments, circuit-breakers, cut-outs, &c., has been issued by the Record Electrical Co., Ltd. (Broadheath, Manchester, and Caxton House, Westminster, S.W.). A large number of patterns of instruments are listed, and the list is not only provided with a thumb index for rapid reference to any particular portion, but a tab at the back makes it readily distinguishable from other lists when filed.

AIR-PUMPS, &c.—An illustrated booklet from the Worthington Pump Co. (India House, Kingsway, W.C.) describes a form of rotary dry vacuum pump or blower which the Company has recently introduced under the name of the “Roto-drum Pump.” This works on the principle of the rotating eccentric drum fitted with sliding plate or piston, which opens and closes by the rotation of the drum. By this special design friction is reduced to a minimum, and the pumps are capable of running at high speeds direct-coupled to electric motors.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in “Electrical Engineering.”

CONDUIT WIRING, &c.—A booklet entitled “Wiring for Electric Light and Power” is being issued by Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), putting forward in well-chosen words the advantages of the Simplex conduit wiring system. The Company has also prepared an attractive series of eight blotting cards, on the backs of which attention is called to details in connection with their conduit system and other lighting fittings and accessories in which they specialise.

WATER STERILISER.—A leaflet from Ozonair, Ltd. (96 Victoria Street, S.W.), gives particulars of a small water steriliser, containing an electric ozone producer, for domestic purposes. The apparatus is quite self-contained, and is put in action simply by turning the tap to draw the water.

ELECTRIC FANS.—A leaflet from J. & W. B. Smith (15-23 Farrington Road, E.C.) gives prices and particulars of several patterns of ceiling, porthole, desk, and bracket fans for continuous and for alternating current.

IRONS AND HEATING APPARATUS.—A new list from the Dowsing Radiant Heat Co., Ltd. (39 and 40 York Place, Baker Street, W.), gives particulars of “Hot Point” electric irons and other heating appliances for domestic and industrial use, most of which are improved patterns of the types of apparatus formerly made by Eastman & Warne. The items include such special applications of electrical heating as collar, cuff, and goffering iron rollers, special heaters for singeing whitewash brushes, hot irons for cutting balata belting, singeing operations in the manufacture of velvet, branders and stamping dies of all descriptions. In a few cases prices have had to be increased owing to the rising cost of raw materials, but in the case of standard articles, now made in larger quantities, the previous low prices have been maintained.

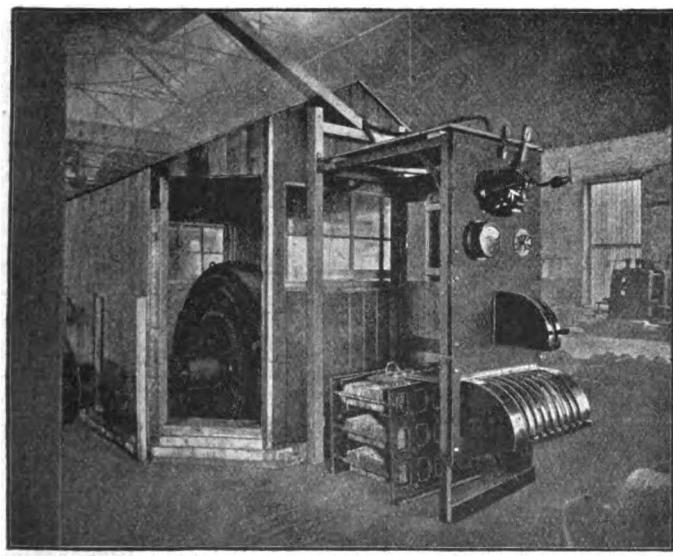


FIG. 2.—“WITTON” MULTIPLE SWITCH STARTER CONTROLLING 300-H.P. ROLLING MILL MOTOR.

starter, the attempt is frustrated by an interlocking bar. This bar is automatically moved along by the switches as they successively close, and precludes the closing of any of the other switches out of their proper sequence. Further, should the circuit-breaker trip due to an overload on the motor and an attempt be made to replace it—which would mean short-circuiting the supply—a special trip coil on the circuit-breaker is energised through contacts which are closed when any or all of the switches on the starter are closed. The action of this trip coil locks the circuit-breaker

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aldershot.—A Local Government Board inquiry is to be held concerning a loan of £8,500 for new plant.

Aylesbury.—Metallic filament lamps from 60 to 400 watts. Town Clerk. June 14th.

Batley.—The L.G.B. has sanctioned a loan of £3,391 for cable extensions.

Burnley.—In view of the L.G.B. policy not to sanction loans for ordinary cables and services, the Electricity Committee has authorised the cost of small cables to connect up new consumers to be met out of revenue.

Manchester.—A 50-kw. steam-driven dynamo is required at the Cottage Homes, Styal, Manchester. Consulting Engineer, Mr. F. W. Page, 14 St. Ann's Square, Manchester. June 16th.

Middlesbrough.—A loan has been sanctioned for expenditure in connection with supply to firms working on Government contracts. A sum required for dealing with ordinary consumers has been refused.

New Zealand.—The Wellington City Council requires two boosters, two switch-panels and instruments. Further particulars at 73 Basinghall Street, E.C.

Stretford.—Cable extensions.

Turton.—Cable extensions and conversion of street lamps from gas to electricity.

Wigan.—Two water-tube boilers and mechanical stokers. Borough Electrical Engineer. June 21st. (See advertisement on another page.)

Wiring

Atherton.—Church of St. John the Baptist.

Belfast.—Guardian offices and board-room. Consulting Engineers, Young & Mackenzie, Clerk to Guardians. June 15th.

Bingley.—Private residence. Architect, F. Atkinson, Penny Bank Chambers, Shipley.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Blackburn.—Warehouses for Star Paper Mill.

Manchester.—Warehouse, Mosley Street. Architects, Pye & Bennett.—Warehouse, Major Street. Architects, J. Swarbrick & Son.

Miscellaneous

Australia.—The Sydney Corporation requires a supply of electric meters. Further particulars at 73 Basinghall Street, E.C. July 19th.

Falkirk.—The Guardians require twelve months' supply of electric lamps. June 16th.

Hull.—The Guardians require six months' supply of electrical goods. Clerk, St. Mary's Chambers. June 19th.

London: *L.C.C.*—The Asylums and Mental Deficiency Committee require four months' supply of electrical sundries and lamps. Clerk, 6 Waterloo Place, S.W. June 14th.

New Zealand.—The Christchurch City Council requires a two years' supply of house service meters. Further particulars at 73 Basinghall Street, E.C.

York.—The Tramways Committee proposed to borrow £30,681 for tramway purposes.

British Industries Fair.—In view of representations made by the exhibitors and buyers at the British Industries Fair, which was held in the Royal Agricultural Hall recently, the Board of Trade has decided to hold another fair in London early next year.

Prohibited Exports.—Included in the new list of articles, the exportation of which from the United Kingdom is prohibited, are tungsten filaments for electric lamps.



TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Leigh (Lancs.).—The following tenders have been accepted:—Rotary converter, Bruce Peebles & Co.; switch-gear, Switchgear & Cowans; water-tube boiler, Stirling Boiler Co.; mechanical stoker, Underfeed Stoker Co.

APPOINTMENTS AND PERSONAL NOTES

Mr. Percy Taylor, Assistant Electrical Engineer, Darwen, who enlisted in the Mechanical Transport service a few weeks ago, has been appointed mechanical staff-sergeant.

Mr. J. C. Whiteley, Assistant Manager to the Chatham and District Light Railways, has been appointed Tramway Manager at South Shields at a salary of £300 per annum.

The Newport Electricity & Tramways Committee recommends that a bonus of £100 each be given to the General Manager of the Department and the Borough Electrical Engineer.

Mr. F. C. Leese and Mr. A. E. Leese, sons of Alderman H. Leese, Stoke-on-Trent, who resigned their positions in the Stoke Electricity Department as mains superintendent of the southern area and switchboard attendant respectively, have each been presented with a gladstone bag by their colleagues. These resignations took place after a discussion in the Corporation a short time ago, in which some strong remarks were made against relatives of councillors being employed by the Corporation.

Mr. T. Duesbury, Borough Electrical Engineer at Sutton Coldfield, has resigned in order to join H.M. Forces. In a letter tendering his resignation, Mr. Duesbury said that "there are almost as many single men of military age sheltering under the municipal umbrella as under the Government umbrella."

We are pleased to note that Lieut. E. G. Boissier, R.N.D. "Howe" Battalion, and late mains superintendent in the Derby Corporation Electricity Department, has been granted the Distinguished Service Cross. Lieut. Boissier has seen much hard fighting at the Dardanelles.

Mr. R. N. Mayne, Borough Electrical Engineer at Redditch, has received a commission in H.M. Forces. The Electric Supply Committee, whilst recognising Mr. Mayne's patriotism, has appealed to him to reconsider his decision on the ground that his presence in the town is equally important, as the electricity undertaking is supplying large quantities of power to firms manufacturing munitions of war.

The Bury Corporation has decided to increase the salary of the Borough Electrical Engineer, Mr. S. J. Watson, from £550 to £650 per annum. There was strong opposition, but the increase was finally sanctioned by 20 votes to 11.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £92 to £93 (last week, £89 10s. to £90 10s.).

Siemens' Lamp Department.—The Sales and Advertising Departments of Siemens Brothers Dynamo Works, Ltd., Incandescent Lamp and Fittings Department, Dalston, have now been transferred to 39 Upper Thames Street, E.C., from which address both the lamp and supplies business will be controlled. The rearrangement is due to the increasing turnover of Wotan and Tantalum lamps. Although large stores were recently acquired at Shacklewell Lane, the introduction of new types of lamps, including gas-filled lamps, demanded further extensions. The Dalston Works will now therefore be devoted solely to lamp manufacture and the output correspondingly increased. All correspondence relating to Dalston material should be addressed to 39 Upper Thames Street, E.C.

LOCAL NOTES

Aylesbury: *Opening of Electricity Works.*—The Council's electric lighting station was formally opened last week. The main contractors for the plant are Messrs. Willans & Robinson, the generators being supplied by the Electric Construction Co., and the switchboard by Johnson & Phillips, who are also the contractors for the whole of the underground cable work and distribution system.

Barrow-in-Furness: *New Plant.*—The Town Council paid a visit of inspection to the electricity works last week on the occasion of the starting up of a new 2,000-kw. turbo-alternator, which, together with the necessary auxiliary plant, has cost £13,000. It is anticipated that ere long it may be essential to replace some of the plant installed at the commencement of the undertaking by more modern machinery.

Dover: *Plant Extensions Postponed.*—The L.G.B. is not disposed to sanction the loan of £6,000 for a new generating set, notwithstanding that this is required in a great measure for naval and military needs. It is suggested to the Corporation that a smaller generating set might be installed in order to reduce the capital expenditure necessary. The Electricity Committee, however, does not regard this as a business proposition, and have decided to hold the whole matter over until a later period.

Dublin: *Electricity Charges.*—The Electricity Committee now definitely recommends that the charge for lighting be increased by 1d., and the power rate by 1d. per unit. This, it is anticipated, will leave a small deficit of £280 on the year's working. On the basis of existing charges it is calculated that the deficit would amount to no less than £21,334.

Grimsby: *Reduced Electricity Revenue.*—The electricity accounts for the last year show a net profit of £721, after meeting expenditure on works of a capital nature out of revenue to the extent of £1,642. Owing to loss in revenue the profits are about £2,000 less than were anticipated.

London: St. Pancras: *Repayment Periods.*—For a long time correspondence has been carried on between the Finance Committee of the L.C.C. and the Electricity Committee regarding the conditions upon which a loan of £15,000 for a 5,000-kw. turbo-alternator should be granted. The two parties are agreed as to fifteen years being the period for this particular item, but the L.C.C. also desire that the Borough Council shall reduce the outstanding period on plant and machinery for which a term of forty-two years has been granted, to one-half, or not exceeding fifteen years. This condition is not to apply to 2,360 kw. of plant of this character which is required for daily use. The Borough Council all along has resisted any reduction in the periods of the older plant, and has again replied that it must adhere to its previous decision in this respect.

Loan for Boilers.—The Electricity Committee recommends that H.M. Treasury be asked to sanction the borrowing of £22,580 for boilers at the King's Road electricity station on the ground that this additional boiler accommodation is very necessary to the undertaking, and that the contract was entered into prior to the war.

Manchester: *The Barton Power Station.*—The Manchester Ratepayers' Association has communicated with the Chancellor of the Exchequer, giving reasons why the Treasury should refuse sanction at the present time to the carrying out of the extension scheme of the Electricity Committee, as reported in our issue of May 27th, p. 230. The L.G.B. Inspector at the inquiry stated that he was instructed to deal with the application immediately. It is claimed that a suspension of the Barton power-house scheme would not entail a severe strain on the undertaking in meeting new applications for supply.

West Bromwich: *Increased Charges.*—Hitherto the increase in electricity charges in most parts of the country has not exceeded 10 per cent., and in some cases it has been only 7½ per cent. In a special report to the Town Council, however, the Electricity Committee recommends that the increase at West Bromwich shall be 20 per cent., in view of the increased cost of materials and wages.

West Saltney: *Electric Lighting Scheme.*—A L.G.B. inquiry was held last week concerning an electric lighting scheme for the district. Mr. J. W. Speight, the Consulting Engineer, stated that the Council had decided to accept the tender of Sandycroft, Ltd., at £5,740, subject to the necessary loan being granted. The district includes Queen's Ferry, and it is anticipated that if the scheme can be put into

operation quickly the Government factory there will take power and lighting. It was also pointed out that in other parts of the district candles and paraffin oil lamps are used for business premises.

"**The Teaching of Electric-Light Switching.**"—A. P. Lundberg and Sons write us as follows:—"We should be obliged if you will allow us to correct a slight misapprehension that may arise from your notice of our pamphlet on the above subject in your last issue. You speak of the "Opinions of some teachers at the end." As a matter of fact, the Opinions are both at the beginning and the end, and include some from very well-known professors, and number thirty-five in all.

Newcastle Local Section of the Institution of Electrical Engineers.—The annual report of the section records the holding of nine meetings at Newcastle, eight meetings of the Tees-side sub-section, and five students' meetings. The present membership of all classes totals 261, notwithstanding a decrease, especially in the students' class, owing to the war. The following officers and committee have been elected for the next session:—Chairman, P. V. Hunter; Vice-Chairmen, H. W. Clothier and A. H. Marshall; Past Chairmen, W. C. Mountain and C. Vernier; Committee, Power Supply Undertakings, F. Fawssett, G. L. Porter, and W. F. T. Pinkney; Corporations, H. S. Ellis and C. Turnbull; Manufacturers, W. G. Guns, T. Carter, and M. G. S. Swallow; Consulting Engineers, C. S. Vesey Brown, R. W. Gregory, and J. R. Beard; Railway Representatives, G. L. Drury and H. Henderson; Scholastic Profession, Dr. W. M. Thornton and F. O. Hunt; Shipyards, Post Office, and Contractors, A. P. Pyne, J. R. M. Elliott, and W. Cross; Hon. Treasurer, C. Vernier; Hon. Secretary, J. R. Andrews; Hon. Auditors, J. H. Holmes and G. Stoney, F.R.S.

EVERY INSTALLATION ENGINEER

Should join his Trade Protection Organisation,

THE

ELECTRICAL CONTRACTORS' ASSOCIATION

(Incorporated).

Inquiries cordially invited by the Secretary,

L. G. TATE,

20, Bucklersbury, LONDON, E.C.

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ARDWICK, MANCHESTER.

Calor

Electric Cookers and

RED HOT FIRES

Electric Light Fittings.

APPLY FOR NEW CATALOGUE JUST ISSUED.

TOWNSHEND'S ART METAL CO., Ltd.,

Works and Showroom—London Showroom—
Ernest Street, Birmingham. 62, Holborn Viaduct, E.C.

TRADES DIRECTORY OF ADVERTISERS IN "ELECTRICAL ENGINEERING."

(One Free Entry is given to every Advertiser. Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).

- Benjamin Electric, Ltd., 1a, Rosebery Avenue, E.C.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.
 E. S. Co., Ltd., 53, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Guibert-Martin, 9, Edmund Place, E.C.
 Haslam & Stretton, Ltd., 11, Windsor Place, Cardiff.
 Lundberg (A. P.) & Sons, Liverpool Rd., N.
 Morris & Lister (London), Ltd., 4, Palace Chas., Westminster, S.W.
 Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
 Simpson (C. M.), 4, St. Augustine's Place, Bristol.
 Sun Electrical Co., Ltd., 118, Charing Cross Rd., W.C.
 Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.

ACCUMULATORS, &c.

- D.P. Battery Co., Ltd., Bakewell, Derbyshire.
 Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
 Naylor Battery Co., 1, Lammermoor Rd., Balham, S.W.
 Tudor Accumulator Co., Ltd., 3, Central Buildings, Westminster.
ARC LAMPS, CARBONS, AND ACCESSORIES.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London Electric Firm, Croydon.
 Oliver Arc Lamp, Ltd., Cambridge place, Burrage Rd., Woolwich.

ARMATURE REPAIRS.

- Marryat & Place, 28, Hatton Garden, E.C.

BOILERS.

- Babcock & Wilcox, Ltd., Oriel House, Farringdon St., E.C.

CABLES, WIRES, AND DUCTS.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Glover (W.T. & Co.), Trafford Park, Manchester.
 Henley's (W.T.) Telegraph Works Co., Ltd., Blomfield St., E.C.
 Hooper's Telegraph & Indiarubber Works, Millwall Docks, E.
 Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
 St. Helens Cable & Rubber Co., Ltd., Warrington.
 Siemens Bros. & Co., Ltd., Woolwich.
 Union Cable Co., Ltd., Dagenham Dock, Essex.

CATALOGUES AND PROCESS ENGRAVING.

- Swain (John) & Son, Ltd., Shoe Lane, E.C.

COIL WINDING.

- Varley Magnet Co., Ltd., Cambridge Place, Burrage Rd., Woolwich.
 • **CONDENSERS (Electrical).**

- Telegraph Condenser Co., Ltd., Vauxhall St., Kennington Oval, S.E.
DYNAMOS see Motors and Dynamos.

FLEXIBLE METALLIC TUBING.

- United Flexible Metallic Tubing Co., Ltd., 112, Queen Vict. St., E.C.

HEATING AND COOKING APPARATUS.

- British Thomson-Houston Co., Ltd., Rugby.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Ferranti, Ltd., Central House, Kingsway, W.C.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London Electrical Trading Co., Ltd., 185, Wardour St., W.C.
 Townshend's Art Metal Co., Ltd., Ernest St., Birmingham.

INSTRUMENTS.

- Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
 Ferranti, Ltd., Central House, Kingsway, W.C.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Kelvin, Bottomley & Baird, Ltd., 18, Cambridge St., Glasgow.
 Nalder Bros. & Thompson, Ltd., 97a Dalston Lane, Dalston, N.E.
 Record Electrical Co., Ltd., Caxton House, Westminster, S.W.
 Weston Electrical Instrument Co., Audrey House, Ely Place, E.C.

INSULATING VARNISH, ENAMELS, PAINTS AND LACQUERS.

- Blume (Chas. H.), The White Building, Sheffield.
 Fredk. Crane Chemical Co., Armoury Close, Birmingham.
 Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

INSULATORS AND INSULATING MATERIALS.

- Macintyre (J.) & Co., Ltd., Burslem.
 Mosses & Mitchell, 122 to 124, Golden Lane, E.C.
 Weidmann (H.) Ltd., Rapperswil, Switzerland.

INSURANCE.

- Phoenix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.
LADDERS.

- Heathman & Co., 10, Parsons Green, S.W.

LAMPS (Incandescent).

- British Thomson-Houston Co., Ltd., 77, Upper Thames St., E.C.
 Cryselco, Ltd., Kempston Works, Bedford.
 Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London & Rugby Engineering Co., Ltd., 36 & 37, Queen St., E.C.

LAMPS (Incandescent)—contd.

- Pope's Electric Lamp Co., Ltd., Hythe Rd., Willesden, N.W.
 Siemens Bros. Dynamo Works Ltd., Tysen St., Dalston, N.E.
 Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
 Stearn Electric Lamp Co., Ltd., 47, Queen Victoria St., S.W.

LAMP FILAMENTS.

- Gmür & Co., Ltd., Aarau, Switzerland.

LEAD, &c.

- Capper, Pass & Son, Ltd., Bedminster Smelting Works, Bristol.

LIFTS.

- Waygood-Otis, Ltd., Falmouth Rd., S.E.

METAL PERFORATORS.

- Harvey (G. A.) & Co. (London), Ltd., Woolwich Rd., London, S.E.
METERS.

- Bastian Meter Co., Ltd., Kentish Town, N.W.

- British Thomson-Houston Co., Ltd., Rugby.

- Ferranti, Ltd., Central House, Kingsway, W.C.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

MICA.

- British Mica Co., Ltd., Lebanon Rd., Works, Wandsworth, S.W.
 Wiggins (F.), & Sons, 102 to 104, Minories, E.C.

MINE EQUIPMENTS AND APPARATUS.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Peebles (Bruce) & Co., Ltd., Edinburgh.

- Reyrolle & Co., Ltd., Hebburn-on-Tyne.

- Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.

- Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.

- British Thomson-Houston Co., Ltd., Rugby.

- Crompton & Co., Ltd., Chelmsford.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Langdon-Davies Motor Co., 110, Cannon St., E.C.

- Matthews & Yates, Ltd., Swinton, Manchester.

- Peebles (Bruce) & Co., Ltd., Edinburgh.

- Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.

- Vickers, Ltd., River Don Works, Sheffield.

OIL CANS.

- Kaye (J.) & Sons, Ltd., Lock Works, Leeds.

PUMPING PLANT.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Merryweather & Sons, Fire Engine Works, Greenwich, S.E.

- Willans & Robinson, Ltd., Rugby.

REPAIRS.

- Marryat & Place, 28, Hatton Garden, E.C.

RUBBER GLOVES.

- Ingram (J. G.) & Son, Hackney Wick, N.E.

- Moseley (D.) & Sons, Ltd., Ardwick, Manchester.

STEAM ENGINES AND TURBINES.

- Allen (W. H.) Son & Co., Ltd., Queen's Engineering Works, Bedford.

- British Thomson-Houston Co., Ltd., Rugby.

- Dick, Kerr & Co. Ltd., Abchurch Yard, E.C.

- J. Howden & Co., Ltd., 195, Scotland St., Glasgow.

- Vickers, Ltd., River Don Works, Sheffield.

- Willans & Robinson, Ltd., Rugby.

STEAM ENGINE ACCESSORIES.

- Lea Recorder Co., Ltd., 32, Deansgate, Manchester.

- United States Metallic Packing Co., Ltd., Bradford.

SWITCHGEAR.

- British Thomson-Houston Co., Ltd., Rugby.

- Dorman & Smith, Ltd., Ordsall Electrical Works, Salford.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.

- Electric Control, Ltd., 177, Reid St., Bridgeton, Glasgow.

- Ellison (George), Warstone Lane, Birmingham.

- Ferranti Ltd., Central House, Kingsway, W.C.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Record Electrical Co., Ltd., Caxton House, Westminster, S.W.

- Reyrolle & Co., Ltd., Hebburn-on-Tyne.

- Switchgear & Cowans, Ltd., Springfield Lane, Salford, Manchester.

TECHNICAL BOOKS.

- Caxton Publishing Co., Clun House, Surrey St., Strand, W.C.

- Constable (Archibald) & Co., Ltd., 10, Orange St., Haymarket, W.

- Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C.

- Longmans, Green & Co., 39, Paternoster Row, E.C.

- Whittaker & Co., 2, White Hart St., E.C.

TELEPHONES.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Gent & Co., Ltd., Faraday Works, Leicester.

- Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, S.E.

- Siemens Bros. & Co., Ltd., Woolwich.

- Western Electric Co., Ltd., North Woolwich, E.

WIRING CONTRACTORS. See page iv.

WOODWORK CASING AND CONDUITS.

- Jennings & Co., Pennywell Rd., Bristol.

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SUMMARY

A DEPUTATION representing the gas and electrical industries waited upon a meeting of members of Parliament on June 9th and discussed the difficulties arising from the shortage of coal supplies.—In the House of Commons last week, the President of the Board of Trade hinted that the Government will, if necessary, bring force to bear to prevent exploitation of coal by the mine-owners. A Government Committee has reported that but for the avoidable absence from work during the past seven months on the part of those engaged in the coal trade, the output could have been increased by some 13 million tons (p. 252).

THE Incorporated Municipal Electrical Association meets to-day and to-morrow in London under the presidency of Mr. A. C. Cramb, the Senior Vice-President. The President, Major H. Richardson, is with the Army (p. 253).

ILLUSTRATED descriptions are given of the cars taking part in the electric vehicle parade to be held this afternoon in connection with the meeting (p. 253).

A NEW British-made electric commercial vehicle is described in an illustrated article ((p. 257).

THE colliery and a new power station, about 80 miles from Berlin, which were to have supplied the Berlin Electricity Works with current, are now to be utilised for supplying an enormous amount of electric power for the "fixation" of nitrogen in a chemical fertiliser works. It is just conceivable, however, that the production of nitrates on this large scale may be primarily for the manufacture of explosives. In consequence of this decision, whatever may be the real reason for it, the municipality of Berlin is taking over the electricity undertaking in that city on October 1st. About £6,500,000 is to be paid for the undertaking (p. 258).

A SCHEME for linking-up the Hammersmith, Fulham, and Battersea electricity undertakings is under consideration. If it is carried into effect it is hoped to relieve the Battersea Council of considerable immediate capital expenditure in meeting the demands upon its mains (p. 258).

THE reversal of single-phase motors is discussed in our "Questions and Answers" columns (p. 259).

AN illustrated description is given of an electrically-equipped shoe factory. (p. 260).

AMONG the subjects of the specifications published by the Patent Office last Thursday were connection boxes, electric vehicle control, conduit fittings, lamp locks, and protective resistances. A telephone transmitter patent is opposed. Patents dealing with electric drills, fuses for explosives and the driving of centrifugal separators expire this week after a full life of fourteen years (p. 261).

A RECENT design of porcelain-handle fuse is illustrated on p. 262.

A 5,000-kw. turbo-alternator is required at Salford; a D.C. generator at Melbourne; cable at West Hartlepool, and electrical supplies at Exeter, West Ham, Brighton, and Bristol (p. 262).

A 25 per cent. increase in the charges for lighting and power is to be made at Kirkcaldy.—The units sold last year at Barrow increased by 1½ million over the previous year.—Half-watt lamps are to be used for street lighting at Ashton-under-Lyne.—A 10 per cent. increase for lighting and power is to be made at Taunton, but no increase for heating and cooking.—The net profit at Lincoln last year was £3,163, against £2,715 in the previous twelve months (p. 263).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

ON the suggestion of General Sir O'More Creagh, V.C., G.C.B., G.C.S.I., an engineer volunteer corps has been raised from members of the engineering profession who are either above military age, or who being of military age are prevented by some good reason from serving in the Regular Forces.

The objects of the Corps are:—

1. To train men of military age and to make them useful Royal Engineer recruits if and when they are able to enlist.

2. To furnish Engineer units to assist in the completion of the Volunteer organisation.

3. To organise the Corps so that the maximum advantage may be taken of the specialised engineering skill of its members at the earliest possible moment.

Drill takes place through the kindness of Colonel Le Rossignol and the officers of the London Electrical Engineers Corps at the Drill Hall, 46 Regency Street, Westminster. The training will be similar to that of the London Electrical Engineer Corps.

Although the first drill only took place on the 2nd inst., already 130 members are enrolled. Membership is not restricted to members of the Engineering Institutions, and application should be made to the Commandant, Lt.-Col. C. B. Clay, V.D., at Marconi House, Strand, W.C.

COAL SUPPLIES

FOLLOWING the deputation of the National Conference on Coal Supplies to Gas and Electricity Undertakings to the Coal Exports Control Committee (ELECTRICAL ENGINEERING, May 27th, p. 224), a deputation representing the gas and electrical industries attended at the House of Commons on Wednesday, June 9th, and laid before a meeting consisting of about two hundred Members of Parliament the serious difficulties in which they find themselves owing to shortage of coal. Lord Claud Hamilton presided. The speakers were Sir Corbet Woodall, Past President of the Institution of Gas Engineers, and Governor of the Gas Light & Coke Co.; Sir John Snell, President of the Institution of Electrical Engineers; Alderman Kay, Chairman of the Gas Committee of the Manchester Corporation; Mr. Frank Bailey, Joint Managing Director of the City of London Electric Lighting Co.; Dr. Charles Carpenter, Chairman of the South Metropolitan Gas Co.; Bailie Irwin, Convener of the Gas Committee of the Glasgow Corporation; and Bailie W. B. Smith, Convener of the Electricity Committee of the Glasgow Corporation.

Attention was drawn by the various speakers to the seriousness of the shortage of coal. This shortage was due to several causes, among which was mentioned particularly the enlistment in the Army and Navy of a large number of miners and the consequent limitation of output. To meet this, further and greater effort was necessary on the part of the miners and the coalowners, which might be stimulated by some limitation of the prices to be charged for coal. Restriction of export of coal was also mentioned. The question of the all-round necessity and utility of gas and electricity was urged at length. It was pointed out that not only were gas and electricity used for lighting, cooking, heating, and power purposes by all classes, but they were also used in a vast number of industries such as engineering works, shipyards, and chemical and textile concerns in all the great industrial centres, where Government work is proceeding night and day, and where it is absolutely essential that the necessary motive power should be continuously available. It was also explained that a number of gas and electricity undertakings had so adapted their plant that they were producing materials of vital importance to the Government, and, furthermore, that the residuals resulting from the manufacture of gas from coal, such as coke, tar, and ammonia, were necessary to a great variety of important industries; also that a considerable supply of high explosives was being obtained from the by-products resulting from the distillation of coal by gas undertakings. In Germany the Government were using every means in their power to restrict the use of coal except in closed vessels, such as retorts and ovens, so as to increase as much as possible the output of the valuable by-products above referred to. Similar action in the United Kingdom would be highly valuable.

In connection with electrical undertakings, the fact was recalled that electricity had reached such a point of efficiency in the use of coal that it was of material advantage in saving the greatest asset of the nation at this time, and that if the electrical supply had to be curtailed or stopped there would be no electrical searchlights, and, in addition, the food supply of London and the country would be in danger owing to the stoppage of the refrigerating plant in the cold-storage warehouses.

Generally speaking, it was an absolute impossibility to take in sufficient coal during the winter for the winter's requirements, and therefore a large stock had to be accumulated during the summer months when the demand was not so heavy. This year it had, so far, been impossible to carry out this system, and if the stocks were not made up by the middle of October the public undertakings would be unable to continue their supply through the coming winter.

Various means of improving matters were suggested, amongst which were mentioned a limitation of further recruiting of miners, a suspension of the operation of the Eight Hours Day Act in respect of collieries in order to increase the actual output of coal, the fixing of a maximum rate of freight for all interned vessels, further facilities generally for the transport of coal, and a continued limitation of the export of coal. Finally, it was urged that if Members representing mining districts could induce their constituents to work full time, a large part of the difficulty of shortage would be overcome.

The Members of Parliament discussed the suggestions put forward at a further meeting on Tuesday. The meeting

generally was in sympathy with these suggestions, and it was decided to appoint a Committee of twelve to interview Mr. Runciman, President of the Board of Trade. This Committee will consist of representatives, in equal proportions, of coal-owners, miners, shipowners, and large consumers, and it is hoped, as a consequence of the interview with the President of the Board of Trade, to be able to make specific recommendations to a further conference between the Members of Parliament and those concerned next week.

In the course of a discussion on the cost of living in the House of Commons on Thursday, Mr. Runciman, President of the Board of Trade, speaking on the question of coal supplies, said there was no commodity the rise in the price of which had given more anxiety than coal. Unlike certain other articles, the price of coal was very little dependent on the world's productions, and it was possible to deal with the situation compulsorily if they could not arrive at an agreement with the merchants and coal owners which was satisfactory to the consumers. It so happened that the small colliers usually engaged in the coal trade in the North were especially suitable for Admiralty purposes, and a great number had been commandeered, whilst the interned ships which were put into the trade in their place were not suitable. Furthermore, the whole of the traffic had been impeded by Admiralty precautions, and a voyage which would ordinarily take a third of a fortnight now took a whole fortnight. So much for the coal-carrying trade. As to coal merchants, it was fair to say that in some respects their expenses were greatly enhanced by the war, but the increased handling expenses were by no means sufficient to explain the enormous rise in prices. The Government, however, had been able to arrange that profits should be strictly limited, and this limitation should keep the price at a fairly steady level. They were therefore thrown back on the coal owners. The chief extra cost, from their point of view, was miners' wages, and the mine-owners put this at 1s. 6d. per ton, but that undoubtedly was a grossly exaggerated figure. The real estimate was much nearer pence than shillings, and it remained a fact that the present pithead price of coal was far in excess of the figure which the expenses of getting coal could justify. The owners argued that the industry was a highly speculative one, and that whilst they made large profits in some years they made very little in others. Communications had taken place between the Government and the owners, however, and an agreement had almost been come to with the Midland coal-owners. It was obvious that if the Government were not fairly met by agreement it would not support any exploitation, and an endeavour was being made to come to agreements which would check the violent fluctuations that were disturbing households and industry.

The report of the Committee appointed "to inquire into the conditions prevailing in the coal-mining industry with a view to promoting such organisation of work and such co-operation between employers and workmen, as, having regard to the large number of miners who are enlisting for naval and military service, will secure the necessary production of coal during the war," was issued last week. This Committee finds that from returns representing 89 per cent. of the total labour employed in coal mines, there was a decrease of 13½ per cent., or 134,186 persons between July, 1914, and February, 1915, and that over the seven months from August, 1914, to February, 1915, there has been an average fall in output of 3,044,529 tons, or 13½ per cent. It has also been found that the absence from work by all classes of mine workers for the seven months preceding the war and the seven months succeeding the war has been practically identical, viz., 10·7 per cent. and 9·8 per cent. respectively, and the conclusion has been arrived at that fully 48 per cent. of this is avoidable absence. The absenteeism, taking the coal-getters only, is very much higher, and if there were no avoidable absence the output would be increased to the extent of between 13 and 14 million tons. The Committee express the opinion that the case has only to be put before the miners in order to secure a great response, and it is proposed that the attention of the Miners' Federation of Great Britain be called to the matter. It is further suggested that owners and workmen should agree to suspend, according to the district conditions, the Eight Hours Act, and that the time appears to have arrived when very full consideration should be given to the question of whether further recruiting among miners should be encouraged. Where the restriction of the export of coal to neutral countries is found to be advisable, it is suggested that special consideration should be given to those mining districts which, to a large extent, depend on export for the existence of their collieries. Another suggestion made by the Committee is that the importance of economy in the use of coal should be brought before the public, and economies in public and private lighting, whether by gas or electricity, and the manufacture of luxuries which require coal, are recommended.

THE I.M.E.A. MEETING

THE Incorporated Municipal Electrical Association will meet in London at the Institution of Electrical Engineers' Building, Victoria Embankment, to-day and to-morrow. The meeting this year is not a social one, and visitors are not invited to attend, but it is intended to devote to-day to serious discussions on the "point five" tariff and the use of electric vehicles in municipal service, and to-morrow to the usual business of the annual general meeting. This afternoon, at five o'clock, there will be a parade of electrical vehicles on the Embankment, and this evening a meeting of the "Point Fives" Association at Tricity House, Oxford Street. At this latter meeting, we are informed that members of the I.M.E.A. who are not "Point Fives," and visitors connected with the electric cooking and heating

industry, will also be admitted. The "Point Fives" meeting will be under the chairmanship of Mr. S. E. Fedden, of Sheffield, and it is to be expected that the main subject discussed will be the effect of the war on the consumption under the "point-five" tariff. The I.M.E.A. meeting will be under the presidency of Mr. A. C. Cramb (Borough Electrical Engineer,

MR. A. C. CRAMB.
(The Acting President.).

Croydon), who, as senior Vice-President, is Acting President for the year. His portrait appears above.



Major H. Richardson, the President, is on active service.

We shall publish a full report of the meeting in our next issue.

The complete programme is as follows:—

TO-DAY (THURSDAY).

10 a.m.—To receive and discuss a report prepared by Mr. A. S. Blackman (Chief Electrical Engineer, Sunderland), and Mr. T. Roles (Chief Electrical Engineer, Bradford), on behalf of the "Point Five" Association, on "The Practical Result of the Point Five Tariff." [This meeting will be restricted to Members and Official Delegates of Local Authorities.]

1 p.m.—Interval.

2.30 p.m.—To receive and discuss a report prepared by Mr. Frank Ayton (Chief Electrical Engineer, Ipswich), Hon. Secretary of the Electric Vehicle Committee of the I.M.E.A., on "The use of Electric Vehicles in Municipal Service." [This meeting will be restricted to Members, Official Delegates of Local Authorities, and co-opted Members of the Electric Vehicle Committee.]

5 p.m.—Parade and demonstration of Electric Vehicles on the Embankment.

7 p.m.—A meeting of the "Point Fives" will be held at Tricity House, Oxford Street, W.

TO-MORROW (FRIDAY).

9.30 a.m.—Council Meeting.

10 a.m.—Annual General Meeting. [This meeting will be restricted to Members and Official Delegates of Local Authorities. Corporation Delegates, other than members, are not entitled to vote.]

AGENDA.

- (1) Annual Report of the Council.
- (2) Balance Sheet and Election of Auditors.
- (3) Scrutineers' Report on the ballot for Officers and Council for 1915-16.
- (4) Place of Meeting for Convention, 1916.
- (5) Other competent business.

1 p.m.—Interval.

2.30 p.m.—If necessary the members will reassemble to complete any adjourned business.

The Council's headquarters are the Hotel Cecil (Strand). By the courtesy of the Municipal and County Club (Whitehall Court), members and delegates are invited to consider themselves honorary members of the club to-day and to-morrow.

THE ELECTRIC VEHICLE PARADE

THE parade and demonstration of electric vehicles which is to take place this afternoon on the Embankment in connection with Mr. F. Ayton's paper on the use of electric vehicles in municipal service, will be of interest as enabling engineers at the meeting to see practical illustrations of points dealt with in the paper. Owing, however, to industrial circumstances connected directly and indirectly with the war, it will not be possible for the parade to form a fully representative collection of types of electric vehicles made and sold in this country, nor a true indication of the progress which is being attained in their use as a result of the indefatigable labours of the Electric Vehicle Committee. Nevertheless, a few electric vehicle firms have been able to promise to send specimens of their cars, and these will be supplemented by examples of electric cars actually in municipal and commercial service, which will have the added interest due to their record of work accomplished. Through the courtesy of some of the intending exhibitors we are able to give the following notes on the vehicles which will be there. The numbers correspond to the order in which the vehicles will be stationed from left to right viewed from the steps of the Institution.

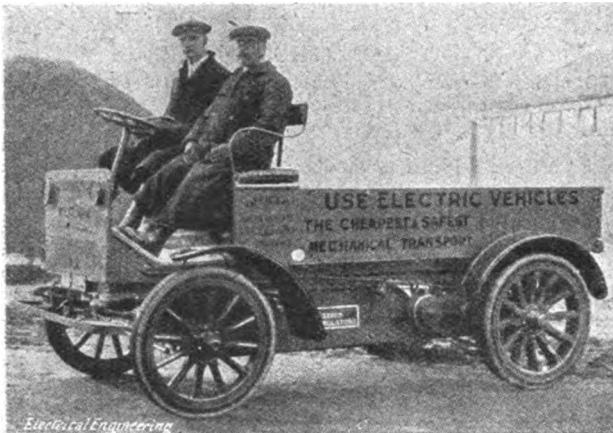
No. 1.—Walker 10-cwt. Covered Delivery Van (Harrod's, Ltd.).

This is one of the large fleet of electric cars which Harrod's, Ltd., have in regular service. It is a covered 10 cwt. van of American origin of a type not very much seen in this country, and its chief peculiarity is the method of driving the rear wheels by a single motor. This motor is in line with the axle, and its shaft carries a pinion on each end in the centre of the road wheel, which gears into a pair of large "idle" spur wheels on either side. These in turn gear into an internal rack near the rim of the wheel. This gear is all covered in by the plate webs of large driving wheels, which gives the vehicle its distinctive appearance. The battery is composed of 60 Edison cells of 220 ampere-hours capacity, and can drive the vehicle at 14 miles per hour. The control of the single motor employed is by a series parallel arrangement of the two halves of the battery contrived with a series parallel arrangement of the field coils and resistance steps.

No. 2.—20-cwt. Open-body Wagon (West Ham Corporation).

This is a good example of a vehicle which has been in active service on the general work of an electricity department. It is a one-ton chassis of one of the lighter types standardised by Edison Accumulators, Ltd. It is driven by a single motor geared to a differential counter-shaft, with a final drive to the rear wheels by side chains. The battery is composed of 60 Edison cells of the A 6 (225 ampere-hour) pattern. The car is capable of a speed of 11 to 12 miles per hour. The control

is by means of a series parallel arrangement of the two sections of the battery and resistance steps, with the addition of series parallel arrangement of the field coils of the motor. This car will be shown with an open float body, but this is removable and can be replaced by the usual type of tower and platform for working on tramway overhead lines and poles. The car is used for mains emergency work. Its full equipment also includes substantial watertight lanterns and flexibles for night work, a portable electric drill, and a small electrically driven



No. 2.—20-cwt. EDISON WAGON (WEST HAM).

centrifugal pumping outfit for emptying flooded sub-stations and similar work. This vehicle has proved of great use to the department, and since it was put into service on Nov. 21st, 1914, it has covered about 1,800 miles with a consumption of 0·5 to 0·6 kw. hour per mile. The cost of energy only without other charges therefore works out at about one ha'penny per mile.

No. 3.—“Opel” 10-cwt. Covered Delivery Van (Marylebone Borough Council).

This is another vehicle which has been employed for the purposes of an electricity department, but in this case principally for delivery work. With its swan breast dash, it is of hand-



No. 3.—OPEL DELIVERY VAN (MARYLEBONE).

some appearance, and its smoothness of running is greatly enhanced by the use of pneumatic tyres. A single motor is employed with a countershaft and side chains enclosed in a gear case, and the control is by series parallel arrangement of the battery in two sections with resistance step. The main controller handle is under the steering wheel. A Hart battery is employed. The vehicle weighs 34½ cwt., and has a speed

of about 13 miles per hour, consuming on an average 0·61 kw. hour per mile. Up to the beginning of April it had run about 5,000 miles, and the total running costs, including driver, maintenance, licences, insurance, &c., amounted to £68.

No. 4.—9-cwt. Covered Delivery Van (General Vehicle Co., Ltd.).

The General Vehicle Company, Ltd. (Imperial House, Kingsway, W.C.) will also take part in the parade, and will be represented by a full panel closed delivery van of 1,000 lb. carrying capacity. This is provided with a 44-cell nine-plate “Ironclad Exide” battery of a capacity of 133 ampere hours, giving a rated mileage of 45 miles on one charge. The battery is carried under a curved bonnet in front.

The speed of the vehicle is 15 miles an hour over good level roads; and the transmission is by single motor with double universal joint shaft and worm drive in rear axle. The worm is the latest Brown type, with steel worm and bronze worm wheel on bevel gear differential. The live rear axle is mounted on Timken roller bearings.

The car is fitted with a three-way type switch (running-



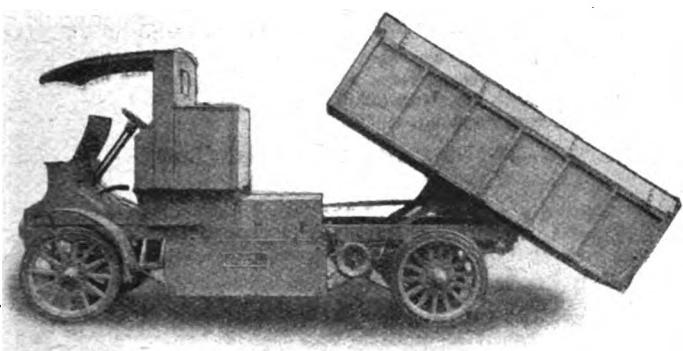
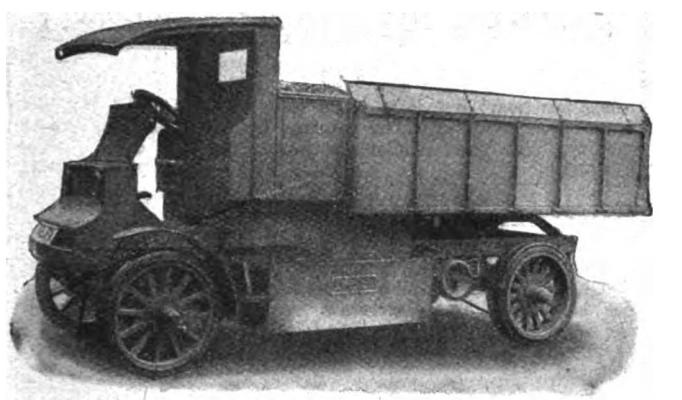
No. 4.—GENERAL VEHICLE CO.’S 9-CWT. VAN.

neutral-charging) in a sheet metal box under the driver's seat. The handle is removable only when in the neutral position, and this constitutes a safety factor when the vehicle is left by the driver. All the wiring is in rigid metal conduit, and the controller is of the “continuous-torque” type, giving four speeds ahead and two reverse. The vehicle is further equipped with the safety devices which, by the interlocking of the control gear, have the following effects:—The application of either brake immediately cuts off the power, if not already cut off by the controller. This allows the driver in an emergency to use both hands in steering the vehicle, and at the same time cut off all power and apply two brakes. Also, the emergency brake cannot be locked except when running switch is either in “neutral” or “charging” positions, and cannot be released until switch is thrown into “running” position. This necessitates that the driver turns off the running switch when leaving the vehicle. It also prevents anyone from releasing the brake while the vehicle is standing, if switch handle is removed. This means the vehicle is left alone in safety. As the brake cannot be released until switch is thrown on, it reminds the driver of that fact upon his return to the vehicle. A further interlock provides that the running switch can be thrown into the “running” position only when the controller is in “neutral” position. This prohibits the accidental starting of the vehicle, which might happen if the controller had been put on during the driver's absence and upon his return he threw on the running switch without looking at the controller.

No. 5.—40-cwt. Tip Van (Edison Accumulators, Ltd.).

This is one of the vehicles exhibited directly by Edison Accumulators, Ltd. (2 and 3 Duke Street, Piccadilly, S.W.), several of whose cars are also shown by users. The arrangement of the chassis of the tip van is generally similar to that of the bare chassis described below, under No. 6, with slight modifications, such as the position of the battery rendered

necessary by the form of the body, which requires the battery to be slung under the frame instead of mounted above it, as in



No. 5.—EDISON 2-TON TIP VAN.

No. 6. The vehicle is built for a load of 2 tons and has a speed of 12 to 13 miles per hour. The battery consists of 60 cells of 300 ampere hours.

**No. 6.—G.M. Type Chassis
(Edison Accumulators, Ltd.).**

The bare chassis exhibited by Edison Accumulators will enable the constructive details to be followed more completely than the complete vehicle. The chassis is of a type that is made in several different sizes for loads from 20 to 40 cwt., and is now used in practically all the company's larger commercial vehicles. It is driven by a single motor, rated at 40 amperes at 72 volts, and running at a maximum speed of 900 r.p.m., situated in the rear of the frame. This drives through a longitudinal flexible shaft of twisted strap form on to a level differential countershaft, while the final drive is by side chains to the rear wheels in the usual way. Unsprung weight is thus reduced to a minimum, and quite a light back axle is permissible. The control is entirely by a lever over the steering wheel, which communicates with a controller under the small bonnet in front of the dash-board, which contains all the control gear in a most easily accessible position. A plain drum type controller of substantial construction is used, providing for five forward and two reverse speeds, obtained by a series parallel arrangement of the field coils combined with series resistance. There is also a switch on the dash-board worked by a removable key with "running," "charging," and "off" positions, and an ampere-hour meter is provided, with the dial neatly let in flush with the dashboard. The control resistance is made up of cast grids in a steel frame, and is mounted under the front end of the frame. There is no pedal control to the motor. The two pedals are both for brakes, one on the motor shaft and the other the usual expanding wheel brake. There are no side levers whatever, but both foot brakes are provided with ratchets, so that they can be kept on when desired, and either can be released by pressure on a knob with the heel of the other foot. The battery is not slung under the frame, as in some electric vehicles, but is carried in a box, the front portion of which forms the driver's seat. In this rigid chassis shown, the battery consists of 60 cells of the "A 6" type of 225-255 ampere-hour capacity, and an

average voltage of 70. The weight of the battery complete is 1,260 lb., and of the chassis without battery 3,061 lb. The normal charging rate is 45 amperes for seven hours. A speed of 10 to 11 m.p.h. is obtained with full load, and on good roads 40 to 50 miles can be covered on one charge, but an extra 15 miles can be obtained by a one-hour boosting charge of the battery. For loads up to 40 cwt. a larger battery of 60 A 8 cells of 300 ampere-hours is employed. It will be seen from these notes that the main characteristics of the design are simplicity and accessibility, and to this is added a robustness of construction which is an equally important feature.

It is unnecessary to recapitulate the constructive features of the Edison alkaline nickel-iron battery. Those unfamiliar with its features may be referred to detail articles which appeared in ELECTRICAL ENGINEERING, October 12th, 1911, Exhibition Supplement, page 67, and May 19th, 1910, page 319, as well as to Messrs. Watson and Mitchell's paper on "Electric Automobiles," read at the 1913 Convention of the I.M.E.A. (see ELECTRICAL ENGINEERING, June 26th, 1913, page 377).

**No. 7.—20-cwt. Edison Covered Delivery Van
(J. Pullar and Sons, Ltd., Perth).**

The chassis of this vehicle is generally similar to that shown as No. 6. The body is that of a covered delivery van, with a carrying capacity of 20 cwt., and the vehicle is capable of a maximum speed of 12 miles per hour. The battery is composed of 60 cells of the Edison A 8 type of 300 ampere-hours capacity.

**No. 8.—"Baker" 20-cwt. Box Van
(Wolseley Motors, Ltd.).**

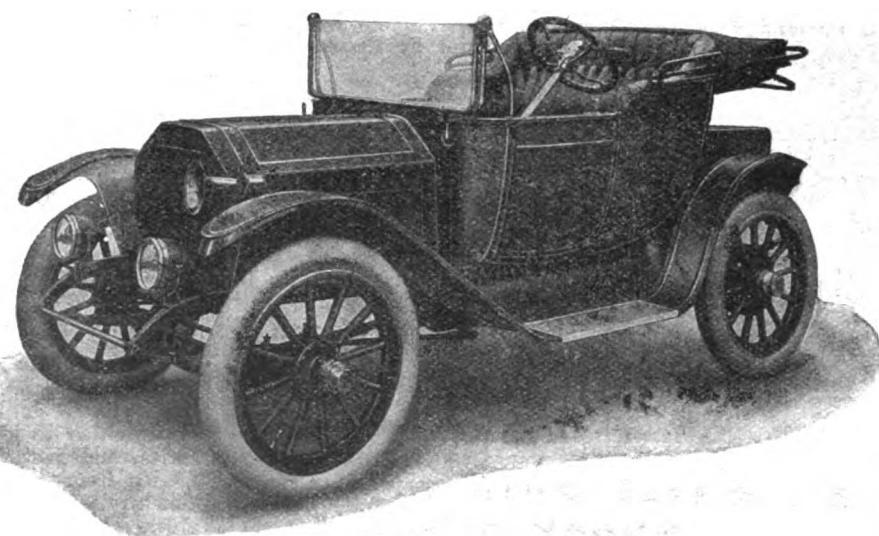
The Baker commercial chassis, which is supplied by Wolseley Motors, Ltd. (Adderly Park, Birmingham), is also of the type driven by a single motor. This drives a differential countershaft through a short, enclosed saw-tooth chain, while the final drive is by enclosed roller chains to the rear wheels. This vehicle carries a load of 20 cwt., a speed up to 10½ miles per hour, and is equipped with a 42-cell "Ironclad Exide" battery of 157 ampere-hours' capacity.

**No. 9.—"Baker" 40-cwt. Chassis
(Wolseley Motors, Ltd.).**

This is a 2-ton chassis of the same type as the previous vehicle (No. 8), only larger. It is capable of a speed of nine miles per hour, and the battery, which is also of the "Ironclad, Exide" type, is of 42 cells of a capacity of 189 ampere-hours.

**No. 10.—Three-seated Passenger Car
(Croydon Corporation).**

This is an example of a passenger car equipped with the Edison battery, and is a car that is in daily use by the Distributing Engineer and Sales Superintendent of the Croydon electricity undertaking, and we understand that it has run its first five months without repairs of any kind. The nature of its work is such that it is only used on the average about 24 miles per day, and it is calculated that the actual running costs have been at the rate of 2·56d. per mile with electricity at 1d. per unit. To this must be added 3·20d. for depreciation. The car has the battery under the bonnet in front, and closely resembles an ordinary petrol car in appearance. From the illustration it will be noticed that the steering wheel is on the left-hand side,



No. 10.—EDISON BATTERY PASSENGER CAR (CROYDON).

which is due to this chassis having been of American origin. Similar cars are, however, now obtainable with the steering

wheel on the right, which, for driving in this country, is preferred by most people. The car is capable of speeds up to 18 and 20 miles per hour, and is equipped with 60 "A 4" Edison cells of 150 ampere-hours capacity. The drive is by a single motor through a worm-gearred live back axle. The control is by means of a series parallel arrangement of the two sections of the battery, in conjunction with series parallel arrangement of the field coils and resistance steps. The controller hand is mounted over the steering wheel.

No. 11.—"Opel" Covered 10-cwt. Delivery Van (Poplar Borough Council).

This is a similar car in general respects to the Marylebone van (No. 3), except that it is equipped with a 44-cell E.P.S. battery, with a capacity of 125 ampere-hours.

No. 12.—Open 15-cwt. Delivery Van (Heston and Isleworth Council).

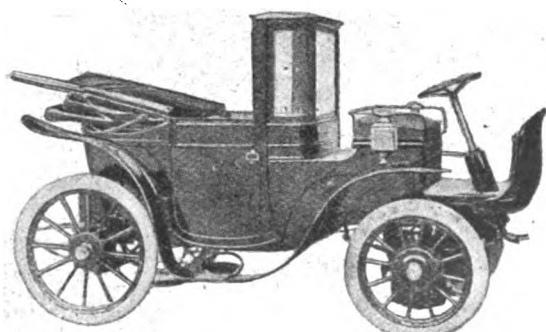
This is a similar vehicle to the last-mentioned (No. 11), except that it is of rather larger size; it is capable of a speed of 14 miles per hour, and has a 44-cell Hart battery of 120 ampere-hours capacity.

No. 13.—Electric Landaulette (Hertford Street Motor Co., Ltd.).

This is an example of a type of four-seater landaulette formerly known as the "electromobile," which has long been familiar in the London streets. The chassis is of British manufacture, being made throughout by Greenwood and Batley, Ltd. (Leeds). A single motor rated at 8 h.p. at 1,500 r.p.m. (continuous rating) is employed, driving the live back axle through enclosed double reduction helical gear. The motor is of special design with two separate armature windings, each with its own commutator, so that this can be grouped in series or parallel. The controller gives three forward speeds, two electric braking positions, and one reverse speed. The controller drum is situated in a horizontal position under the floor boards in front of the driver's seat, and is actuated by a hand lever mounted on the steering column immediately under the wheel. A quick break switch is connected with the foot brake, so that when it is applied, the main circuit is broken, no matter what is the position of the controller. Various makes of battery are employed, the standard size is 45 cells of 150 ampere-hours capacity. These are placed in a single box slung under the car, and very easily removable. Further details of this chassis were given in ELECTRICAL ENGINEERING, Vol. 1, p. 653, April 11th, 1907, and the very complete arrangements for looking after the batteries were described in a special article on the Company's garage in Hertford Street in ELECTRICAL ENGINEERING, Vol. II., p. 792 (Nov. 21st, 1902).

No. 14.—Electric Landaulette (Kriéger Electric Carriage Syndicate).

The Kriéger Electric Carriage Syndicate (48A Gillingham Street, S.W.) will be showing one or possibly two of their landaulettes, of which a considerable number are at work in London. The Kriéger system of drive by motors geared to the front wheels, and arranged to turn with them for steering purposes, had its origin in France some years ago, although it was subsequently adopted in cars made in other countries. The two motors which drive these landaulettes are each rated at $3\frac{1}{2}$ h.p., and a special feature of the system is that they are compound wound. The first four speeds are obtained by the controller



No. 14.—KRIÉGER LANDAULETTE.

putting both motors in series with either compound or series fields, and utilising either half or full voltage of the battery, and the two highest speeds are obtained by connecting the motors in parallel with series or compound fields. Owing to the presence of the shunt windings a regenerative braking effect can be obtained on certain steps of the controller. In the latest types of vehicle a pedal control is provided by which the motors may be cut out of circuit immediately, and cut in again through a rheostat. The vehicles shown will both be equipped

with Naylor batteries, which have been found very durable and to be specially able to stand rapid charging. Forty-six cells are carried, half in the front portion, and half in the rear of the car. The ordinary size of battery used has a capacity of 175 ampere-hours, which is sufficient for about 45 miles on one charge, but a larger battery can be provided in the space available. The ordinary speed attained is about 20 miles per hour, but it is quite easy to run up to 30 miles per hour when required. The carriage bodies provided are of high quality, and the vehicles do not exceed 31 cwt. in weight complete.

No. 15.—"Millburn" Coupé (Heath's Garage, Ltd., Birmingham).

This is another type of private passenger car for town work, seating four persons and travelling at speeds up to 20 miles per hour. The motor drives a worm-gearred live axle, and the car is equipped with a "Philadelphia" lead battery of 20 cells of 204 ampere-hours capacity, thus being of an unusually low voltage.

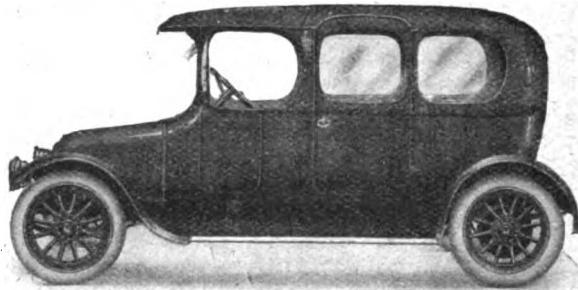
No. 16.—"Lang" Coupé (Heath's Garage, Ltd., Birmingham).

The same firm are showing a second four-seated coupé of another style, geared for a rather higher speed (24 m.p.h.), and equipped with an Ironclad Exide battery of 41 cells of 137.5 ampere-hours capacity.

No. 17.—70-cwt. "Baker" Electric Lorry (Wolseley Motors, Ltd.).

This is a heavier size of the Baker vehicle represented in its lighter types by Nos. 8 and 9. It has a carrying capacity of $3\frac{1}{2}$ tons at 8 to 9 miles per hour, and is equipped wth a 42-cell "Ironclad Exide" battery.

The above are all the cars mentioned in the official programme, but it is probable that one or two more will be officially present. We understand, for example, that the use of the Edison battery to propel a luxurious pleasure car will be demonstrated by Edison Accumulators, Ltd., in a vehicle similar to that illustrated here. This handsome carriage has an all-metal domed limousine body mounted on a chassis made by Arrol-Johnstone, Ltd., driven by a single motor rated at



EDISON LIMOUSINE.

45 amperes at 60 volts. This is situated near the middle of the frame, and drives the live back axle through a worm gear. The battery, neatly packed away in the lower part of the vehicle, partly in front and partly behind the motor, is composed of 60 "A 5" Edison cells of 188 ampere-hours capacity, giving 50 to 60 miles on one charge. The control gear is of a simple nature. Plain series resistances are used on the first few steps, and as there is only one motor with a single commutator series parallel, control is not made use of in any way, nor is there any alteration in the grouping of the cells, which are kept permanently in series.

The Electrical Emergency Service.—We are still able to receive a few more names for enrolment in the Electrical Emergency Service. Although the waiting list is now fairly long, owing to geographical considerations, it may not be long enough to supply a sudden call for men in some districts of London. As our readers know, the object of the service is to do the work of switchboard attendants, who desire either to join the Army or to work in munition factories, and gentlemen of every rank in the electrical profession from the highest to the lowest are volunteering for this service. An application form will be found on p. vii.

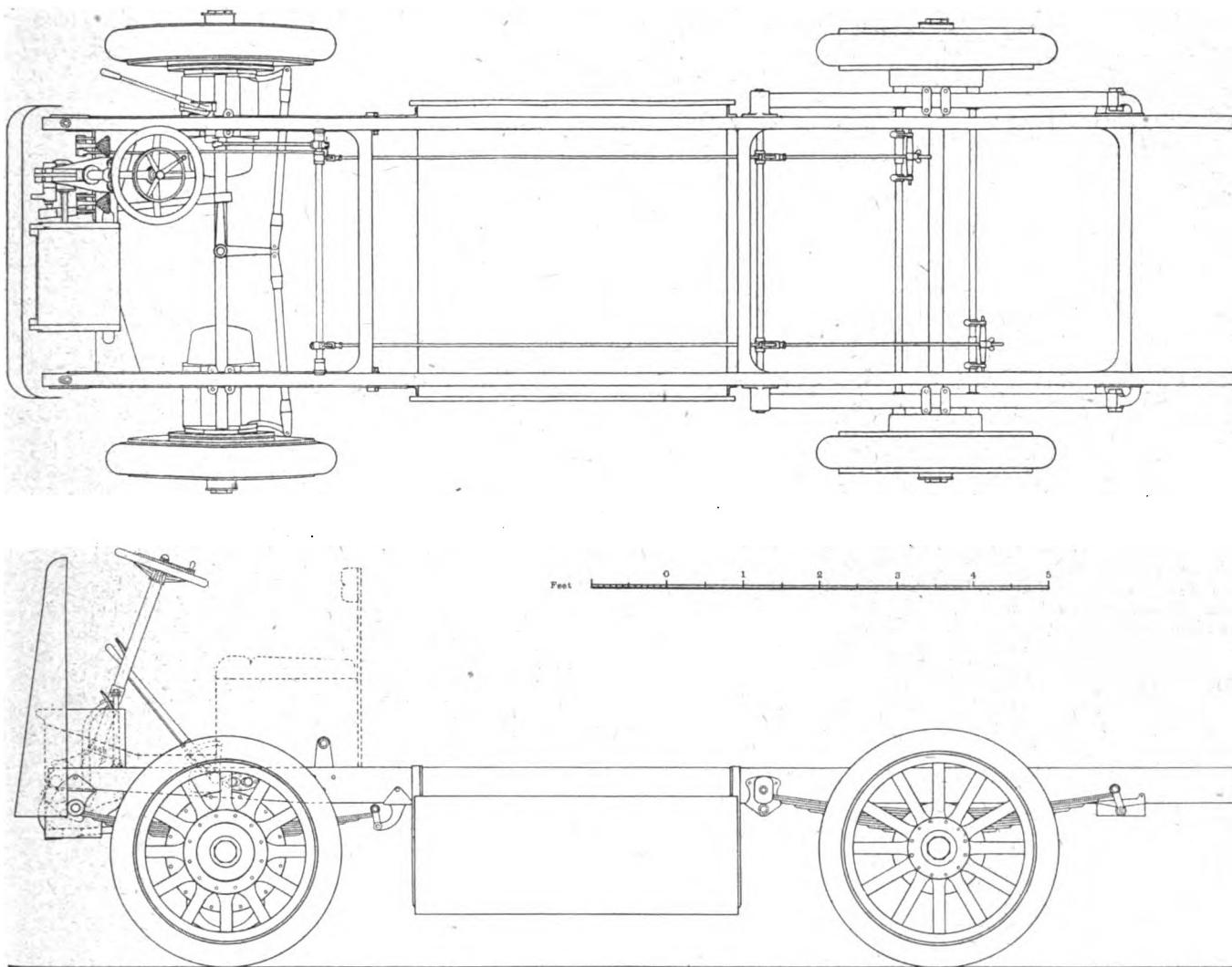
Physical Society.—At the meeting to be held at the Imperial College of Science, South Kensington, S.W., on Friday, June 25th, the two following Papers are on the agenda:—(1) "A Theory of Electrical Resistance of Metals," by Sir J. J. Thomson, F.R.S.; (2) "On an Unbroken Alternating Current for Cable Telegraphy," by Lieut.-Col. Squier (U.S.A.).

THE ORWELL COMMERCIAL ELECTRIC VEHICLE

CONSIDERABLE progress has been made in the manufacture of the first batch of a new series of electric commercial vehicles which are being constructed at Ipswich by Ransomes, Sims & Jefferies, Ltd., and for which the sole selling agents are Mossay & Co., Ltd. (Queen Anne's Chambers, Tothill Street, Westminster). It will be remembered that this firm were at one time agents for a foreign-built electric vehicle (see ELECTRICAL ENGINEERING, Vol. X., p. 143, March 12th, 1914), and we must congratulate them on the promptness with which, on the revelation of the true character of the country of this vehicle's origin, they made arrangements for its replacement by an entirely British vehicle of a design which embodies many improvements upon its predecessor.

in "Timken" conical adjustable roller bearings. They are compound wound, and are of 2·5 or 2·75 h.p. normal rating, according to the load to be carried.

The control gear embodies considerable improvements, and is designed and made by G. Ellison (Birmingham). The whole of the control mechanism is contained in an aluminium case bolted to the front cross-member of the frame, and, in addition to containing the two control drums, charging plug arrangements, &c., has the instruments mounted on the top. The main control drum is for altering the motor connections, and is worked by a lever on the top of the steering column. It provides for fine forward running positions, a rheostatic braking position, and one reverse. The battery always had all its cells in series, and the changes effected on the various steps are as follows:—Forward speeds: 1st speed, armatures and series fields all in series, with shunt windings across the battery in series; 2nd speed,



PLAN AND ELEVATION SHOWING GENERAL ARRANGEMENT OF CHASSIS OF ORWELL ELECTRIC COMMERCIAL VEHICLE.

An elevation and a plan showing the general arrangement of the chassis is shown in the figure. The feature of front drive is retained, with separate motors geared to the road-wheels and mounted so as to move with them for steering purposes. The control is all mounted behind the lower part of the dashboard, and the battery box is slung below the centre of the frame, so that the maximum platform area is available for the load. Three sizes are standardised to carry 1½, 2, and 2½ tons respectively, all of the same general over-all dimensions, but differing, of course, in the size of the motors and mechanical proportions.

The motors drive through single reduction helical gear, and the position and angle of the steering pivots is such as to protect the steering wheel from road shocks, so that remarkably easy steering is obtained, notwithstanding the fact that the unsprung weight of the motors has to be turned with the wheels. The motors are made by Ransomes, Sims & Jefferies themselves, and are totally enclosed with aluminium end shields and easily removable watertight covers. They run

the same, with the shunt windings cut out; 3rd speed, shunt windings as in 1st speed, armatures still in series, but series windings cut out (this position gives a regenerative braking effect when the speed exceeds 6 or 7 miles per hour, and can be used for coasting downhill); 4th speed, motors in parallel, with shunt fields as in 1st speed; 5th speed, the same, with shunt windings cut out. The reverse is with the motors in series. Current is never broken on this controller, but there is an auxiliary controller worked by a pedal, which breaks the circuit when pushed forward and makes it, and gradually cuts out resistance when let back. This is mechanically interlocked with the main controller, so that the circuit must be broken whenever the main controller is moved. The pedal is thus worked in driving exactly like the clutch pedal of a petrol car. The auxiliary controller is fitted with a magnetic blow-out. Another important feature of the interlocking arrangements is that the charging plug can only be inserted when the controller is in the "off" position, nor can the vehicle be started while

the charging plug is in place. Also when the charging receptacle is free to receive the plug the whole controller is necessarily dead, so that it can be opened up for cleaning and inspection, or taken to pieces during charging. Another point to which special attention has been paid is the provision of a spring step-by-step movement to the auxiliary controller combined with a suitable amount of backlash to the pedal so that it is impossible to stop between two resistance steps. There are, in addition to the electric brakes, two internal expanding brakes, actuated by a pedal and side lever respectively, on the rear wheels.

The battery of 40 cells is carried in boxes, which can be let down on to rollers and slid out sideways in sections from either side for inspection, or drawn right out for replacement. Either "Ironclad Exide" or "Tudor" batteries can be supplied under excellent guarantee conditions and maintenance contracts. The capacities vary from 102 to 280 ampere hours, and a mileage of 35 to 45 per charge is obtainable, with a maximum speed on the level of 11 to 12 miles per hour.

The chassis is suitable for any kind of body. A special design of top van has been prepared, involving a very ingenious tipping mechanism worked by two screws of unequal pitch, which slides the body out at the same time as tipping it. This can be worked by a small motor if desired. Two dustcarts on this principle for Birmingham and for Wolverhampton are already on order, and other cars under construction include a 30-cwt. van for the Midland Railway. An improved type of tower waggon body can also be fitted. The company have some other types of vehicle in preparation, among which we understand is an electric platform luggage truck and a tractor for dealing with ordinary vehicles involving some novel features, which we hope to refer to at a later date.

MUNICIPALISATION OF THE BERLIN ELECTRICITY WORKS

To Prevent a Bread Famine!

IN the history of municipal electrical control nothing has been more startling than the sudden decision of the Berlin Municipality to take over the electricity supply undertaking owned by the large and successful company, the Berliner Elektricitätswerke, which has hitherto been responsible for the whole of the electricity supply in Berlin. The works are to be transferred to the Municipality on October 1st, but the decision was arrived at by the Berlin authorities on February 23rd, and confirmed by the Town Council in March. The purchase price will be about £6,500,000.

This decision was quite unexpected, and the circumstances which led to it were certainly remarkable. The A.E.G. Co. of Berlin, with which the Berliner Elektricitätswerke has always been intimately connected, are also interested in a very large electric power station which is being erected near Bitterfeld, and is working in conjunction with the Golpa-Jessnitz Colliery. It was from these works that current was in future to be supplied to the Berlin Electricity Works, although the distance is over eighty miles. Last February it was announced, however, that this would no longer be possible, as the Golpa-Jessnitz-Bitterfeld people had entered into a contract to supply 500,000,000 units a year for fifteen years to the Bavarian Nitrogen Works for the production of chemical fertiliser. This supply is to start by the end of the present year, and, reading between the lines of the German newspaper announcements, it appears not improbable that the scheme has directly or indirectly the support of the German Government. This may have been in view of the necessity of maintaining and increasing the wheat crop, in spite of the present practical impossibility of Germany obtaining chemical fertiliser from South America, due to the blockade by the British Fleet, but it is also just conceivable that the "fixation" of nitrogen which the Bavarian nitrogen works has in contemplation is not merely for the purpose of manufacturing calcium nitrate for the fertilisation of the soil, but is primarily for the production of nitrates for the manufacture of explosives.

In any case, it seems that the electric supply company anticipated considerable difficulty in obtaining the necessary coal for the Berlin electricity works without being able to rely on the Golpa-Jessnitz Colliery, and has therefore been unwilling to renew its agreement with the Berlin municipality for the public and private electricity supply in that city.

We understand, from information published in the German Press and received by us through our correspondents in Switzerland and Denmark, that the whole of the electricity

supply to Berlin and its suburbs will be taken over by the municipality, and will be administered by a Board of fourteen members. The technical managers will be Dr. H. Passavant, E. Wikander, G. Wilkens, and Dr. Brühl.

With regard to the Bitterfeld power station, it is stated that in addition to the contract for 500,000,000 units a year already mentioned, a further output of 250,000,000 units is being spoken of for another purpose. The transmission pressure is to be 80,000 volts, and eight generating sets of an aggregate capacity of 180,000 kw. are to be put down—four of them immediately.

IMPORTANT LINKING-UP SCHEME FOR LONDON

AN important scheme for linking up the generating stations of the Battersea, Fulham, and Hammersmith Councils was to have come before the Hammersmith Borough Council yesterday, after we had gone to press. We hope to give the result in our next issue. Upon the scheme coming into operation it will be possible, by arrangement, to shut down during certain times two out of the three central stations concerned and supply the whole of the three areas from one station. The same advantage would apply to week-ends and Bank Holiday periods, thereby ensuring a substantial saving in labour and fuel by the three authorities, as well as affording great advantages in the execution of repairs to the steam plant. A further advantage to be gained by each of the three authorities concerned is that it will not be necessary for each to have such a large reserve plant in their respective stations as hitherto, as it is proposed to provide that a stand-by supply as well as a bulk supply shall be furnished if required. In a report the Electricity Committee state that the question has recently become somewhat acute, owing to the fact that the Battersea Council must meet certain large additional demands for electricity in the immediate future. This can only be done by an extension of their existing station or by putting into operation at an early date the proposed linking-up scheme. In these circumstances, the Borough Council is recommended to agree to the proposal to link up the three stations.

The scheme provides for laying a connecting cable between the generating stations of the three authorities at an estimated cost of £17,441, to be borne in equal shares. In addition, each authority will bear the cost of the necessary transforming apparatus, meter switches, and the buildings for such plant to be placed at each generating station, so that the total estimated cost to each Borough is as follows:—One-third part of cost of connecting main, £5,813; transforming apparatus, &c., £2,500; total, £8,313.

The Electricity Committee remarks that in all probability no difficulty will be placed in the way of the Council obtaining a loan for these sums, to be repaid on the usual terms and within the usual periods, should they decide to go forward with the work. It is suggested that the agreement between the three authorities should cover a period of twenty-five years, after which, in the event of the agreement being terminated, the authority within whose district the connecting mains and the extensions thereof are situate will take over such mains upon a proper valuation. The ultimate estimated cost, therefore, to the Hammersmith Council will be £8,313, less the residual value of the mains and plant in twenty-five years' time, and the Committee are advised that such residual value ought to be a very considerable sum.

The details of the proposed agreement are still under consideration, and it is proposed in due course to submit an estimate of the capital expenditure involved in the proposal to the Finance Committee for consideration and report. In the meantime, however, in view of the fact that the Battersea Borough Council are compelled to consider at an early date the furnishing of the additional supply above referred to, it is important that the other Councils concerned should express their views generally upon the scheme.

The Faraday House Journal.—The current issue of the magazine and journal of past and present students of Faraday House contains particulars of the part being played in the war by many Faradians, as well as other news and a technical article on the "Third Harmonic in Transformers."

Obituary.—We regret to note that Major E. L. Baddeley, of the 8th Battalion Lancashire Fusiliers, has been killed in action at the Dardanelles. Major Baddeley was secretary to W. T. Glover & Co., Trafford Park, Manchester.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,447.

Why have the so-called "non-arcing metals" not been generally adopted for fuse-wire?
(Replies must be received not later than first post, Thursday, June 24th.)

ANSWERS TO No. 1,445.

Explain how to reverse the direction of rotation of a single-phase induction motor with squirrel-cage rotor, also of a single-phase repulsion motor with a D.C. armature, which is permanently short-circuited.—"J. B."

The first award (10s.) is made to "J. G. M." for the following reply :—

Fig. 1 shows diagrammatically a single-phase motor and its starter. The starter consists of a choking coil and a

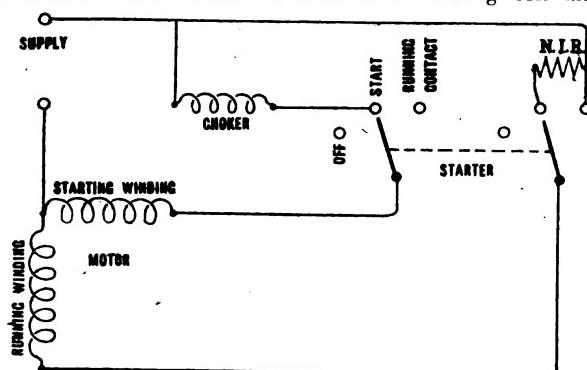


Fig. 1.

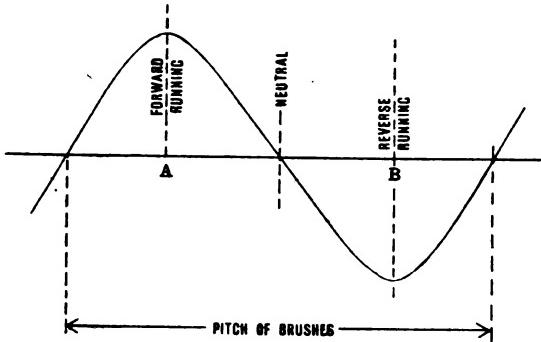


Fig. 2.

non-inductive resistance, which, by means of a switch, can be coupled in series with the starting windings and running winding respectively, and when the machine has got up speed the starting winding is open-circuited and the running winding is put directly across the supply. The choking coil

causes the current in the winding in series with it to lag, producing an approximation to a rotating field, the direction of which determines the direction of rotation of the armature. The machine may therefore be treated as a two-phase motor, and can be reversed by changing over the connections of either the starting or the running winding. The terminals of most machines are arranged in such a manner as to make this a simple operation. If for any reason it is not desirable to interfere with the connections in the machine, the same result may be obtained by altering the starter. The choker must be put in place of the resistance and the resistance connected in place of the choker. This will, of course, cause the current to lag in the other phase or winding, which will have the same effect as reversing the connections of one of the windings. In small machines the resistance is sometimes dispensed with, in which case care must be taken to avoid burning out the starting coil. As this is only in circuit for short periods, it is usually rated very high, and, if designed to run with the choking coil in series with it, will probably burn out if coupled directly across the supply. If therefore the choker is taken out of the starting circuit, it should be replaced by a non-inductive resistance to keep the current down to a safe value. In the case of repulsion motors the position of the brushes will have to be changed. The curve (Fig. 2) shows roughly how the speed varies with the brush position. Assuming the brushes to be in position A, which is the normal running position in forward direction; they will have to be moved to position B to produce the desired result. The new position is best determined experimentally; the brushes should be moved forward (or backward, whichever is most convenient) until the neutral point is reached when the armature will not tend to revolve in either direction. This position should be marked and then the brushes moved the same distance beyond this, which will be the best position for reverse running.

The second award (10s.) is made to "E. H." who writes as follows :—

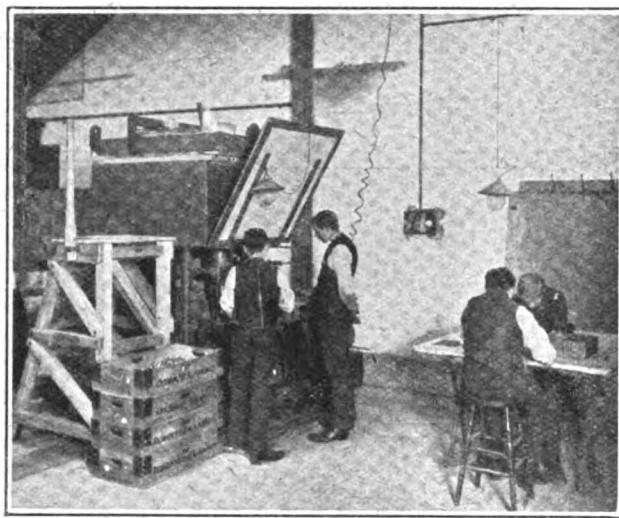
Single-phase induction motors are generally started by splitting the single phase in some way or another, or, in other words, by converting the machines temporarily into polyphase motors. One of the commonest methods of attaining this object is to wind the stator with two separate sets of coils—a "running" and a "starting" winding. In series with these are connected a resistance and a choking coil respectively, the effect of which is to cause the current in the starting phase to lag nearly 90° behind that in the running phase, and hence to produce a rotating magnetic field. With a squirrel-cage motor the values of the resistance and of the inductance of the choking coil must obviously be greater than with the slip-ring type. The rotation of such a machine is reversed by reversing the direction of rotation of the magnetic field. This can be accomplished in one of two ways: (1) by crossing over the leads to either the running or the starting phase, but not to both; or (2) by interchanging the resistance and the choking coil. In the case of a comparatively small motor starting under light load, a simple method of reversing the rotation is to switch only the running phase and its resistance across the mains, and start the motor by hand in the desired direction. The motor will then run up to speed without any difficulty. The single-phase motor of the simple-repulsion type is generally started by shifting the position of the short-circuited brushes. When the machine is at rest, and the brushes are connected to conductors which are midway between the poles, the equivalent of a transformer on no-load is obtained. If the brushes are shifted in either direction, the armature starts rotating in the opposite direction. Thus, suppose a clockwise rotation is desired, then the brushes must be shifted in a counter-clockwise direction. Were the brushes shifted until they were in contact with conductors from under the centre of the pole, the motor would again come to rest; it would then be acting as a short-circuited transformer, and take a tremendous current in the stator windings. A further shift of the brushes would cause the motor to reverse its rotation. If it were possible to move the brushes of a two-pole repulsion motor through a whole revolution, the direction of rotation would be reversed four times.

ANSWER TO CORRESPONDENT

F. B.—The new edition of the Standardisation Rules for Electrical Machinery of the British Electrical and Allied Manufacturers' Association can be obtained at the price of one shilling from the Secretary of the Association, King's House, Kingsway, W.C.

BRITISH MADE LAMP CAPS

HERE is a somewhat widespread belief that one of the most essential parts of an incandescent lamp, the cap, is always imported from abroad, though (as was announced in ELECTRICAL ENGINEERING, September 24th, 1914, p. 518) the Osram Lamp Works, Ltd., and the Robertson Lamp Works, Ltd., manufacture these at their Hammersmith factories. The illustration, which shows part of the cap-making



LAMP CAP MAKING AT THE OSRAM LAMP WORKS,
HAMMERSMITH, LONDON.

plant of the Osram and Robertson companies at Hammersmith, is, we believe, the first of an English cap-making plant to be published, and is thus of special interest. The Osram and Robertson Companies, moreover, manufacture every other part of their incandescent lamps at Hammersmith with the exception of the glass bulbs, which, as hitherto, are made at Lemington-on-Tyne. Both companies, therefore, are entirely independent of any foreign source of supply.

AN ELECTRICALLY DRIVEN SHOE FACTORY

MESSRS. W. EDWARDS & SON, of Norwich, have recently erected a three-storey factory on the banks of the river Wensum, that may be considered as the last word in up-to-dateness. The designers of this establishment



FIG. 1.—B.T.-H. ELECTRIC MOTOR, MOUNTED NEAR CEILING,
DRIVING TWO LINES OF SHAFTING IN MACHINE ROOM, MESSRS.
EDWARDS & SON, NORWICH. B.T.-H. ELECTRIC FLAT IRON USED
FOR "BACKING."

realised to the full that to light and drive factories by means of electricity is the safest, cleanest, most efficient, and least expensive method; for to every conceivable piece of ap-

paratus, and in any kind of factory, electric driving and lighting can be advantageously applied. Messrs. Edwards are fortunate in being able to secure their supply of electricity from the mains of the Norwich Corporation, whose charges are very low, making it an attractive centre for boot manufacturers who are contemplating fresh fields of operation. The maximum floor space has been secured by placing the B.T.-H. electric motors which drive the machinery near to the ceiling in iron cradles, grouping the machines they drive so that the smallest number of belts and line shafts are required. As it is a function of the electric motor to work equally well whether placed on floor, pillar, or ceiling, there has been no sacrifice in efficiency by placing the motors near the ceiling as Messrs. Edwards have done. Two sizes of B.T.-H. electric motors have been standardised for use throughout the factory, i.e., 10 h.p. and 15 h.p., with speeds of 1,000 r.p.m.

The advantages of electric drive may be summarised as follows :—

The cost is always proportional to the actual work done. Whether under- or overloaded, the electric motor is always highly efficient. No attention and few and inexpensive repairs are necessary. Electric motors are easily and quickly installed, and require no special foundation or alteration to existing arrangements. Electric motors are small and compact, and, if necessary, can be fixed to wall or ceiling. In any case, only a negligible amount of space is occupied. A single machine can be used at any time without running the whole power plant. Electric motors are perfectly safe, and factories equipped with them obtain preferential insurance rates. They create no fumes or dirt. They are vibrationless and practically noiseless. They can be started by simply throwing over a switch—which is an entirely "fool-proof" piece of apparatus. Extensions to the factory can easily be made. There is no need to instal more power than is neces-



FIG. 2.—B.T.-H. ELECTRIC MOTOR, 10 H.P., DRIVING MACHINERY
IN VELDT-SCHOEN MAKING ROOM, MESSRS. EDWARDS & SON,
NORWICH. MOTOR MOUNTED NEAR CEILING LEAVES FLOOR SPACE
CLEAR. MAZDALUX LIGHTING AND SPECIAL UNIVERSAL FITTINGS.

sary at the moment. Additional motors can be installed as required without disturbing the original plant.

The entire factory is lighted by electricity, drawn-wire Mazda lamps shaded by "Mazdalux" reflectors being used and arranged so that the light is concentrated on the work and not in the eyes of the operatives, there being an entire absence of glare, with a resulting saving of eye-strain to the operatives. In the case of special machinery, such as consols, stitchers, pull-over machines, &c., the fittings are of the "Universal" type with Mazdalux reflectors, enabling the operator to place the light in the most desired position. The equipment of the different departments consists of the latest types of shoe machinery supplied by the British United Shoe Machinery Co., Ltd., and the Singer Co.

The press room, which contains double open-end presses, "Nickole" evening and grading machine, twin sole moulder, "Planet" sole-rounding, "Acme" heel-building machines, universal slingers, and the usual complement of skivers, splitters, and preparing machines, is driven by a 15-h.p. motor. The "clicking" room, which contains clicking presses, is driven by a 10-h.p. motor. In this room the electric irons are used for "backing," and have been found extremely satisfactory. The machining room contains closing machines, button-hole machine, hand-meshed folder, power hammer, and edge-cementing machines, driven by the motor in the clicking room. The machine-sewn making room is driven by a 10-h.p. motor, and contains assembling machine, pull-over machine, lasters, wire grip backer, rotary pounding-up machine, sole sewers, leveller, channel closing and edge-raising machine, and cementing machine. The veldt-schoen department is driven by a 10-h.p.

motor, and contains a veldt assembling machine, laster, rotary pounding-up machine, rapid stitchers, veldt-trimming machines, wire grip tackers, channel-laying and sleeking machine, tack-pulling machine, universal slugger, and channel opener. The turn-shoe department is driven by two 10-h.p. B.T.-H. electric motors, and contains lasting machines, wire grip tackers, turn-shoe sewing machines, channeller, turn-shoe reforming plant, universal slugger, and heel-attacher. The finishing room, heeling department, and stock room are driven by two 15-h.p. B.T.-H. electric motors; the finishing room contains top ironing machines and polishing shafts; the heeling department contains

universal sluggers and lightning healer; the stock room contains a power monogram machine. The drying room is heated by electricity and fitted with electric fans. A 40-in. duplex dust-exhauster, driven by a 15-h.p. motor with special speed regulation, has been installed in the finishing room.

The British Thomson-Houston Co., Ltd. (Rugby), supplied all the electric motors for driving, the Mazda lamps and Mazdalux reflectors, and the electric irons, and the planning and carrying out of the electrical installation was done by Mr. R. A. Lower, of the Norwich Corporation.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 10th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

11,889/14. **Connection Box.** St. HELENS CABLE and RUBBER Co. and J. C. WHITE. Connection boxes for surface wiring in which the terminals fit in recesses, are arranged round a common centre, and are slotted in directions substantially parallel to the directions in which the cables enter. (Nine figures.)

12,047/14. **Electric Vehicles.** B.T.-H. Co. (*General Vehicle Co., U.S.A.*). A control system for electric cars in which the control gear is interlocked so that the controller is returned to the off position whenever either of the brakes is applied. The emergency brake is locked in position when the running switch handle is removed, and when the running switch has been moved to the off position it is impossible to move it to a running position unless the controller is in the off position. (Six figures.)

12,599/14. **Conduit Fittings.** SIMPLEX CONDUITS, LTD., and L. M. WATERHOUSE. A conduit fitting, comprising a body fitted with outlet branches, and having an inspection opening with a lid, also provided with an outlet, so arranged in relation to the others that when the fitting is placed in the angle between a ceiling and a wall, it is adapted to connect a line of conduit in the angle, with one along the ceiling and one up the wall. (Eight figures.)

12,906/14. **Lamp Lock.** G. WHARRAM. A lamp lock for bayonet-socket lamps, consisting of a metal plate with a hole for the bayonet pin of the lamp, and shaped to fit against the lamp cap, provided with a projecting tongue in such a position as to admit of being folded back into the holder slot, and a lip which can be folded over the outside of the holder. (Two figures.)

15,356/14. **Protective Reactances.** J. S. HIGHFIELD and W. DUDDELL. A graded protective reactance coil in which the condenser action between adjacent turns is smaller at one end of the coil than at the other, and gradually increases from end to end, the end with the small condenser action being connected to the line, and the other to the machine to be protected from surges. Arresters may be connected between points on the graded coil and earth. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WALKER [Cable box compound] 17,686/14.

DYNAMOS, MOTORS AND TRANSFORMERS: COMPAGNIE DE L'INDUSTRIE ELECTRIQUE ET MECANIQUE [Dynamos] 13,159/14.

Electrometallurgy and Electrochemistry: HIGHFIELD [Smelting of ores] 4,937/14 and [Electric furnaces] 2,728/15; ASHCROFT [Fixation of nitrogen] 10,420/14.

Ignition: MCCLEMENTS [Sparkling plugs] 20,156/14.

Instruments and Meters: HAMILTON and FERRANTI, LTD. [Mercury meters] 12,926/14; BROGGER [Moving coil instruments] 14,557/14.

Storage Batteries: MARQUISE DES LIGNERIS [Light accumulator] 12,720/14.

Switchgear, Fuses and Fittings: BASTIAN [Resistances] 12,867/14; B.T.-H. (*G.E. Co., U.S.A.*) [Series parallel con-

trollers] 13,147/14; PIEPER und PIEPER [Automatic control for compressors] 16,130/14; PETERS [Reactance coils] 23,359/14; LUCAS and EDWARDS [Switches] 1,328/15.

Telephony and Telegraphy: AKTIESELSKABET ELEKTRISK BUREAU [Automatic telephones] 9,822/14; PEDERSEN [Wireless receivers] 12,364/14; MARCONI'S TELEGRAPH Co. and ROUND [Vacuous tubes used as magnifiers and producers of continuous electrical oscillations] 13,247/14 and [Production of continuous oscillations] 13,248/14; HULTMAN [Telephone exchanges] 13,362/14; GOLDSCHMIDT [Mechanical selector for wireless receiving apparatus] 15,082/14; WILEY [Printing telegraphs] 21,538/14; BELLINI [Directive wireless telegraphs] 22,879/14; MARCONI'S WIRELESS TELEGRAPH Co. and ROUND [Cathodes for oscillation tubes] 6,476/15.

Traction: MAJOR [Tramway rail joints] 20,635/14.

Miscellaneous: FULLER, FULLER, and FULLER [Batteries] 18,713/14; FARNSWORTH [Vapour electric rectifiers] 1,870/15.

Amendments made

*5,328/13. **Sifting Machine.** C. W. COMBS. This specification, which describes an electrically-driven sifting machine, has been amended by way of disclaimer.

Opposition to Grant of Patents

9,637/14. **Telephones.** E. C. R. MARKS (*Electrical Experiment Co., U.S.A.*). Opposition has been entered to a grant on this specification, which describes transmitters with rigid diaphragm lightly supported by pneumatic cushions exerting an aperiodic resilience, and permitting the diaphragm to vibrate as a whole in accordance with sound vibrations.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

12,382/01. **Electric Drills.** G. F. CAMPBELL and S. T. ISHERWOOD. Portable electric drilling machines, dispensing with the use of flexible or jointed shafts, with the motor mounted on trunnions and a telescopic shaft.

12,721/01. **Fuses for Explosives.** H. and H. TIRMAN. A machine for making electric fuses for cartridges or explosive charges.

12,739/01. **Driving of Centrifugals.** G. POTT and R. WILLIAMSON. Driving of centrifugal separators, &c., by a motor coupled to a loose sleeve, which drives the main vessel through a centrifugal friction clutch.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A BLONDEL [Enclosed flame arc lamps] 4,677/06.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. CO. (*G.E. Co., U.S.A.*) [Control of motors actuating water-tight doors of ships] 4,513/06.

Electrochemistry and Electrometallurgy: F. I. GIBBS [Electro-deposition] 4,410/08.

Ignition: A. J. BOULT (*L. Macquaire*) [Sparkling plugs] 4,991/04.

Switchgear, Fuses and Fittings: F. W. SUTER [Holder for tubular lamps] 4,608/08.

Miscellaneous: H. HIRST and S. D. WHITE [Burglar alarms] 4,468/07; H. W. RAVENSHAW, V. G. MIDDLETON, and W. E. TOWNSEND [Magnetic clutches] 4,849/06; W. D. WHYTE [Ship's compasses] 4,885/06.

"WITTON" HANDGUARD CUT-OUTS

UNCEASING endeavours have been made by the General Electric Co., Ltd. (Witton, Birmingham, and 67 Queen Victoria Street, London, E.C.), to develop lines of switch-gear and accessories which shall comply to the full with Home Office requirements for the protection of the operator. For many years the Company has been supplying a shielded cut-out complying with these regulations, but it has recently improved upon this design by the introduction of "Witton"

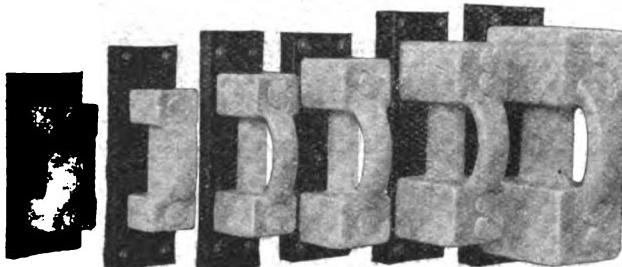


FIG. 1.—RANGE OF "WITTON" HANDGUARD FUSES.

handguard cut-outs, which are made in an extensive range, a few of the sizes being shown in Fig. 1. The object of this new design is to provide a completely protective guard for the hand, precluding the possibility of a live contact being touched while removing or inserting the fuse-carrier. The handle and carrier is composed of one porcelain block enclosing the contacts of the fuse-carrier and the clips on the base. The operator is, therefore, able to get a firm grip of the handle without the hand coming in the vicinity of live parts. In addition, the fuse possesses a self-aligning contact of new design carried on the fuse-carrier. It is mounted on the porcelain carrier by a stud projecting horizontally into the porcelain and held by a nut, the recess for which is seen from the front of the carrier and is closed by a porcelain cap

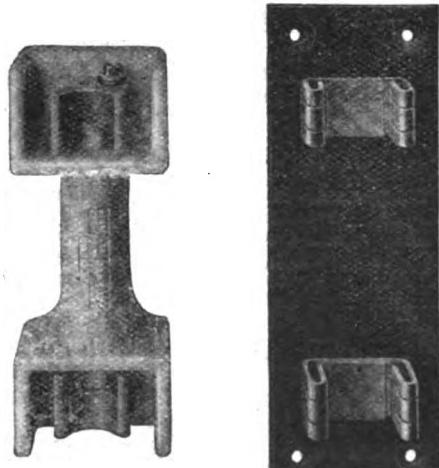


FIG. 2.—CONTACTS ON CARRIER, AND CLIPS ON BASE OF "WITTON" HANDGUARD CUT-OUT.

cemented in. The contact is not held tightly against the porcelain, but is separated from it by a spring washer, which gives the contact a small amount of freedom in every direction without interfering with its general rigidity. This freedom is adequate to enable the contacts to adjust themselves to meet any want of alignment in the clips.

A further feature of the handguard cut-out is its adequate ventilation. As will be seen from Fig. 2, each contact is cut away at the base so that ample facilities are provided for the access of air to the fuse wire. The latter is carried in the usual asbestos tube which passes through the tubular carrier. The cut-out is made in a number of sizes, ranging from 15 to 600 amperes, and the Company has not changed the prices as compared with its older "Home Office" pattern.

**TENDERS INVITED AND PROSPECTIVE BUSINESS****Generating Stations, Sub-Stations, Mains, &c.**

Australia.—The Melbourne City Council requires a D.C. generator. Specifications, &c., from Messrs. McIlwraith, McEacharn & Co., Biliter Square Buildings, E.C.

Eastbourne.—The Electricity Department requires about 160 ft. of 14-inch cast-iron circulating water piping and valves. Borough Electrical Engineer. June 26th. (See an advertisement on another page.)

Salford.—An additional 5,000-kw. turbo-alternator is to be installed at the Frederick Road power station, at an estimated cost of £16,200.—Twelve months' supply of maximum-demand indicators, motor carbon-brushes, tools, &c. Borough Electrical Engineer.

West Hartlepool.—An application is to be made for a loan of £1,000 to meet the next three years' requirements in respect of mains.

Wiring

Dublin.—Technical schools, 18 Rutland Square. Secretary, Technical Education Committee. June 21st.

London.—Four blocks at Grove Fever Hospital, Tooting Graveney, S.W. W. T. Hatch, Metropolitan Asylums Board, Embankment, E.C. June 30th.

West Bromwich.—Electric lighting of new buildings in Great Barr Park for Walsall & West Bromwich Unions Joint Committee. Architect, G. McMichael, 105 Colmore Row, Birmingham. July 5th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Ellesmere Port.—New Council offices (£5,500).

Glasgow.—Springbank school. Clerk, School Board Offices, 129 Bath Street. June 19th.

Heywood.—Warehouse for T. Isherwood & Co.

Ilkley.—New school.

London.—Labour Exchange, Canning Town. H.M. Office of Works, Storey's Gate, S.W.

Salford.—Warehouse for Crompton & Co., Hope Street.

Tonbridge.—Post office and telephone exchange. H.M. Office of Works, London.

Miscellaneous

Brighton.—Twelve months' supply of electrical fittings for the Guardians. Clerk, Prince's Street. June 22nd.

Bristol.—Six or twelve months' supply of electrical fittings for the Guardians. Clerk, St. Peter's Hospital. June 21st.

Exeter.—Twelve months' supply of electrical appliances for Devon County Asylum. E. H. Harbottle, County Chambers, Queen Street, Exeter. June 29th.

West Ham.—Three months' supply of electrical fittings for the Union. Clerk, Union Road, Leytonstone.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Bradford.—The tender of the M. & G. Truck Engineering Co. has been accepted for 100 tramcar trucks, and that of Brown, Boveri & Co. for 200 tramcar motors.

Caledonian Railway Co.—A contract has been placed with the Edison & Swan United Electric Light Co. for Royal Ediswan lamps.

Chesterfield.—The following tenders have been accepted in connection with the £5,000 extension scheme:—400-kw. alternator, British Westinghouse Co., £877 10s.; boiler, superheater, and mechanical stoker, Babcock & Wilcox, £1,472; economiser, Clay Cross Co., £359.

Stoke-on-Trent.—Messrs. Venner & Co. have received a twelve months' contract for Chamberlain & Hookham meters.

Wallasey.—Contracts have been placed with the British Thomson-Houston Co. and Ferranti, Ltd., for a year's supply of A.C. meters.

We are informed by the Synchronome Co., Ltd., that their system of electric clocks is being installed in a large number

of factories and shipyards, and in many places now used as war hospitals. The electric time circuits at the Euston Station of the L. & N.W. Railway, at the Waterloo terminus of the L. & S.W. Railway, and at Port Sunlight for Lever Bros., are also being extended, in addition to other public buildings.

Messrs. Venner & Co. have received contracts for twelve months' supplies of Chamberlain & Hookham meters from the Paisley and Wallasey Corporations.

APPOINTMENTS AND PERSONAL NOTES

A proposal by the Barrow-in-Furness Electricity Committee that an honorarium of £100 be granted to Mr. H. R. Burnett, the Borough Electrical Engineer, has been rejected by the Council by 18 votes to 8. It was pointed out that the honorarium was not for extra work done during the war, but in recognition of strenuous work carried out by Mr. Burnett during the past two years.

The recommendation of the Newport (Mon.) Electricity Committee that a bonus of £100 should be paid to the General Manager and the Borough Electrical Engineer has been passed by the Corporation after some strong remarks by several members. It was pointed out that the two officials in question had succeeded in making the undertaking, which for years had made no profit, a successful one financially.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £96 to £97 (last week, £92 to £93).

Advance in Prices.—Kelvin, Bottomley & Baird, Ltd., announce an increase of 10 per cent. in all their prices owing to the rise in cost of material and labour.

LOCAL NOTES

Ashton-under-Lyne: *Street Lighting.*—Half-watt lamps are to be substituted for arc lamps for street lighting purposes.

Barrow-in-Furness: *Electricity Accounts.*—The accounts of the electricity undertaking for the past twelve months show a net profit of £3,163 against £513 in the previous year. The output has increased from 2 million to 3½ million units, and the generating costs have been reduced from 1¾d. to 0¾d. In submitting these accounts, Alderman Smith said that although there was every indication that the output during the next twelve months would be much larger, there must be set off against this the increased price of coal, a tender having been accepted that day at 5s. per ton more than last year.

Burton: *Low Charges Justified.*—Speaking at the last meeting of the Corporation, the Chairman of the Electricity Committee said that the low charges of the Electricity Department for power purposes have been fully justified, as the output had doubled in the last five years, and trebled in the past ten years. The profit-sharing scheme for the workmen had worked out at about 6 per cent. per annum on the men's wages, whilst the new plant recently installed at the electricity works had effected a saving at the rate of £2,000 per annum.

Hove: *Progress of Municipal Undertaking.*—In answer to questions at the last meeting of the Corporation, the Chairman of the Electric Lighting Committee said that as the Government had stopped all capital outlay, it was impossible to proceed with the linking up of the whole system to the Corporation's electric supply undertaking as was intended when the Hove Company was taken over. Pending this, the Corporation was compelled to continue the arrangements with Brighton for supply to the Aldrington district.

Kirkcaldy: *25 per cent. Increase in Charges.*—The deficiency on the accounts of the electricity undertaking for the past year is put at £3,000, to meet which it has been decided to increase the charges for lighting and power by 25 per cent.

Lincoln: *Electricity Accounts.*—There was an increase of 9 per cent. in the output last year, and the financial result was a net profit of £3,163 as against £2,715 in the previous twelve months. There was a decrease in working expenses of £543 due to economy effected by the new plant and the lower price of coal.

Lynn: *Public Lighting.*—The question of why the public lighting was being charged at a higher rate this year than last whilst the total number of units consumed was 25,000 less, was raised at the last monthly meeting of the Corporation. It was pointed out that since January there had been practically no public lighting, yet the amount charged was higher, and if there had been extra cost of production at the power station generally, then this should have been spread over the whole of the consumers. It was explained that it was impossible to alter the balance-sheet, but it had been arranged to reduce the public lighting by £300 for the current twelve months.

Taunton: *Electricity Deficit.*—The loss on the past year's working of the electricity undertaking is put at about £500, and an advance of 10 per cent. in the prices for current is recommended. This, however, is only to apply to lighting and power, a resolution that it should also apply to heating and cooking being lost.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

India Rubber, Gutta Percha & Telegraph Works Co.—It has been decided to abandon the half-yearly meeting this year on account of the war. The works at Silvertown are very busy in many departments, and it is anticipated that the year's results will be favourable, although the prices of labour and coal are considerably higher than last year. An interim dividend is to be paid on the 5 per cent. preference shares, and 2½ per cent. on the ordinary shares.

National Electric Supply Co.—An interim dividend of 2s. 6d. per share, less tax, is recommended on the ordinary shares.

The Association of Consulting Engineers.—The annual meeting of this Association was held on May 31st, Mr. G. Midgley Taylor presiding. The Chairman mentioned that the Committee had had under consideration the model general conditions of the Institution of Electrical Engineers, to which objections had been raised in some quarters. It was felt that general conditions should be applicable to contracts generally, and that works pertaining to the electrical branch of the profession should not require any special treatment, and the objections relate chiefly to points wherein the electrical conditions differ from those commonly accepted in other branches of engineering. The objections have been communicated to the Institution of Electrical Engineers. Another matter in which the Association has taken action is in opposing the issue of advertisements inviting engineers to send in applications and fees for carrying out engineering works, and it is probable that the Local Government Board will be approached on the subject. The following were elected to fill vacancies on the Committee:—Mr. W. Ll. Preece, Mr. W. J. E. Binnie, Mr. E. L. Mansergh, Mr. E. B. Taylor, Mr. W. Emmott, and Mr. F. W. Hodson.

Industrial Organisation.—In a contribution to the *Journal* of the Institution of Electrical Engineers, Lieut. W. Pollard Digby discusses the need for the adequate organisation of industry in this country, and shows how necessary it will be for many economic reasons, "when military war again gives place to the commercial warfare waged by manufacturing countries for food-stuffs and luxuries," to strain every nerve to apply system to our methods. He concerns himself particularly with means for obtaining the necessary information as to the requirements of overseas markets, as well as the doings of foreign competitors, and after a sketch of the present schemes of commercial attachés, trade commissioners, &c., put in a plea for a similar but much more extensive and thorough-going scheme of scientific and technical commissioners to carry on investigations relating to engineering and other industries all over the world. He discusses at some length the type of man required, the necessary equipment of education and experience, and outlines the kind of work to which these specialists in different branches should devote themselves.

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SUMMARY

A DETAILED and illustrated description of the electrical installation at Lyons' new Regent Palace Hotel is commenced (p. 265).

A LARGE proportion of our space is devoted to a full report of the meeting of the Municipal Incorporated Electrical Association last week. On Thursday morning a report on the results of the point-five tariff was discussed at considerable length, and the disclosure that in some cases the tariff had resulted in decreased revenue in spite of large increase in units sold led to much comment. The discussion also dealt largely with the rateable value system of charging (pp. 267-271).

A REPORT on the use of electric vehicles in municipal service by Mr. Ayton was read in the afternoon and a number of members gave their experiences and ideas in the discussion (pp. 271-275).

THE point-fives meeting gave occasion for a debate of a thoroughly practical nature as usual (p. 275).

ON Friday the Annual General Meeting was held and the new Council elected. Mr. A. C. Cramb (the Acting-President) will continue as President (p. 276).

FURTHER progress has been made by the deputation representing gas and electrical interests regarding coal supplies (p. 279).

AN electric platform truck is described (p. 279).

A PROBLEM relating to the connecting up of motor starters is discussed in our "Questions and Answers" columns (p. 280).

AMONG the subjects of specifications published last Thursday at the Patent Office are heating elements, series generators, oscillation valve tubes for wireless telegraphy and telephony, automatic telephones, and joint-box compound (p. 281).

A 5,000-kw. turbo-alternator and water-tube boiler is

required at Halifax; a 2,000-kw. turbo-alternator, condensing plant, switch-gear, etc., at Erith; extensions estimated to cost £27,000 are contemplated at Luton, and an electric lighting plant is required for a sanatorium near Manchester (p. 281).

EXTENSIONS at Torquay have been stopped by order of the L.G.B.—A further scheme for the reconstruction of the Belfast Electricity Department has been prepared.—The Osram & Pope case has commenced (p. 282).

THE ELECTRICAL INSTALLATION AT THE REGENT PALACE HOTEL

THE electrical installation at this recently-opened London hotel—probably one of the largest in Europe, accommodating as it does 1,500 guests—is naturally on a very large scale, and we are indebted to Messrs. J. Lyons & Co., to Mr. A. H. Barker, the consulting engineer, who designed the ventilating, heating, and general engineering plant, and to Mr. Cushion and Mr. Goddard, the chief and second electrical engineers to the Company, for permission to inspect the arrangements and to publish some notes with regard to them.

The ventilation of the principal reception-rooms is on the "balanced" system. Washed air is supplied by two large centrifugal fans, but each principal room has its own

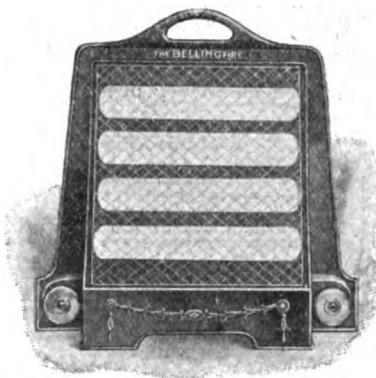


FIG. 1.—BELLING ELECTRIC FIRE AS USED IN THE BEDROOMS.

independent extract fan. There are two inlet ducts for each room, one for cold and one for hot air. In the kitchen there is a "false ceiling," which is perforated with numerous holes in removable panels, enabling the whole ceiling to be taken down for cleaning; this large ventilating space, in connection with a 4-ft. 10-h.p. "Sirocco" blower of sufficient power, enables the whole of the air to be changed in 1½ minutes. In the bedrooms fresh air can be introduced from adjacent areas, or warmed air from the corridors, at the will of the occupant, and the outlet of the vitiated air is through a trunk to the top of the building. The lavatories and baths are ventilated by extract fans, which withdraw the air to the roof. For this system of ventilation there are 31 fans, aggregating 82 h.p.; the two large main fans are each of 10-h.p. capacity. There are 300 miles of pipes and

about 15 miles of air ducts. Messrs. J. Jeffreys & Co., Ltd., were the contractors for the general heating and ventilating installation.

Probably the Regent Palace is the only hotel in which provision is made for electric heaters in every guest's bedroom. Those at present installed (about 120) are standard Belling electric fires of $1\frac{1}{2}$ -kw. size, as shown in the illustration. The general heating of the building is partly by hot-water radiators and partly by vacuum steam, and steam-pipes are, of course, employed for heating the air for ventilation. Electric thermostats made by the Steam Fittings Co., Ltd., are employed for controlling the temperature in both cases. This apparatus consists of a solenoid-operated double-beat valve (Fig. 2) operated by an electric thermometer, the latter depending for its action on the differential expansion of a combination of metals so arranged as to make and break a platinum contact when the temperature varies from that to which the thermometer is set by means of a regulating screw. When the desired temperature is reached, the circuit of a solenoid is closed, and the polar extension of its casing attracts a pure nickel disc attached to the double-beat valve, lifting the valve to its seat and shutting off the supply of steam. When the temperature falls, say, 1° Fahr., the contact is again broken, and the valve falls from its seat and allows steam to flow full bore.

In connection with the ventilating system, a 2-in. electric valve working at 15 lb. steam pressure is fitted to the steam coil in both main air ducts. These valves are each worked by an electric thermometer specially constructed for atmospheric control and set for 65° Fahr., which are fitted in the

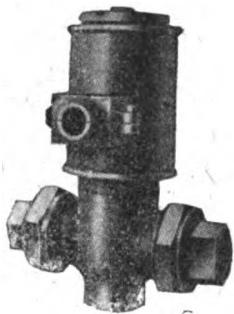


FIG. 2.



FIG. 3.

air ducts some considerable distance away from the heating coils to prevent their being influenced by direct radiation.

The hot-water supply is controlled similarly to the ventilating; in this case the thermometer is of special construction to admit of its being immersed in the liquid the temperature of which it is to control. Fig. 3 shows this special thermometer, which in action is precisely the same as the thermometer for air, and admits by means of the regulating screw a regulation of temperature over a range of 110° Fahr., and will maintain the temperature for which it is set (in this case 180° Fahr.) within 1° or 2° Fahr. There are five $1\frac{1}{2}$ -in. and one 1-in. electric valves working at 90 lb. steam pressure, each operated by an electric thermometer fitted to the calorifiers. The solenoids of all these electric valves take current direct from the 220-volts supply.

Before leaving the subject of the heating and ventilating, mention may be made of the "control room," although it is not yet equipped. This room will contain instruments to indicate the temperature and pressure of the air in any part of the building, the volume of air being supplied to the reception-rooms, the water level in each of the sixteen large water tanks, the boiler pressure, and the proportion of CO_2 in the flue gases, and it will also be possible to control the temperature and pressure of air in the principal rooms directly from this point. Mr. Barker had designed special instruments and apparatus for this room, and, having been unable in the first instance to induce makers in this country to take up its manufacture, had placed the order in Germany shortly before the war broke out. It then, of course, became essential to order the apparatus here, and we understand that the necessary arrangements have been made, but not without considerable difficulty. Mr. Barker contrasts the apathy of the British manufacturers in this connection with the keenness of the Germans to obtain the order.

We have already referred to the large number of electric heaters and the electric fans. The electrical installation includes also 6,000 Osram lamps, 26 electric lifts, and several motors for miscellaneous purposes, such as knife-cleaning, silver-cleaning, ham-cutting, mincing,

refrigeration, pneumatic tubes, pumps, sewing machines, boot-cleaning, and hair-dressing. The electrical energy is taken from the St. James's & Pall Mall Electric Light Co.'s network at 220 volts D.C. For the heater circuits two pairs of 0'8 sq. in. cables are brought in directly from the Carnaby Street sub-station, and the main distribution board controlling the heater circuits is in a separate chamber in one of the sub-basements. The board is 30 ft. long, and has 60 pairs of cartridge fuses, and 54 pairs of 19/16 cables lead to the distribution boards on the various floors; there are six distribution boards on each floor.

For the lighting and power two pairs of still

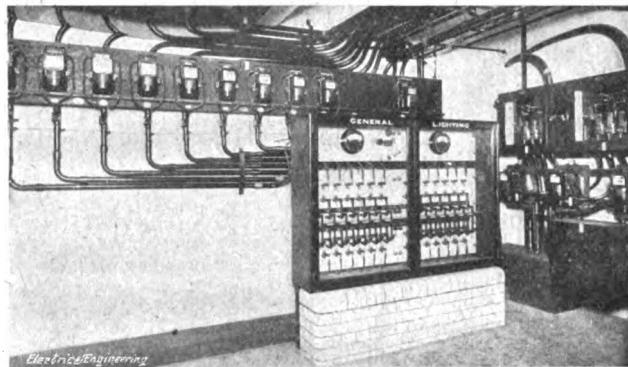


FIG. 4.—ONE OF THE MAIN LIGHTING BOARDS AND THE SUPPLY COMPANY'S BOARD.

larger cable, viz., 1'2 sq. in., are led in, one being on the Supply Co.'s special "theatre" main with its large battery reserve. The two pairs of mains terminate in separate switchrooms, and the two bus-bars in which the two terminate are connected in parallel through a circuit-breaker, so that in the event of the failure of the supply from one pair of mains the current is automatically cut off from that side, and, after the link of the defective side has been removed, the circuit-breaker can then be replaced and the whole load thrown on the opposite side. The lighting of the building is divided equally over the two mains, and each half is again divided, as the circuits to

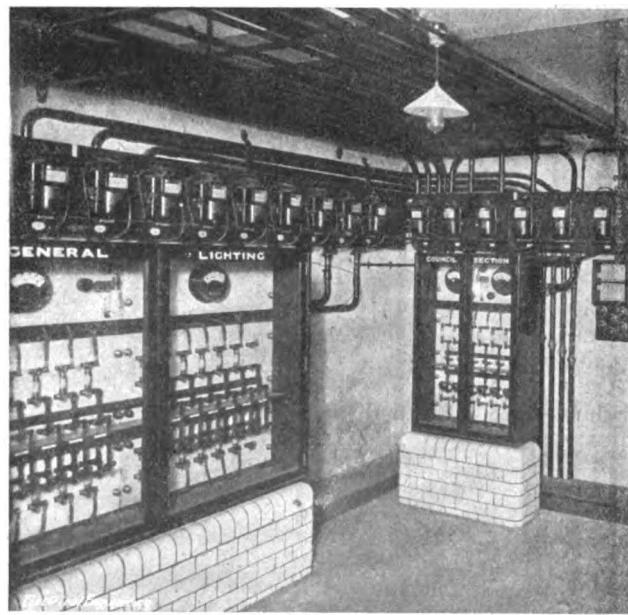


FIG. 5.—THE OTHER MAIN LIGHTING BOARD AND ONE OF THE "POLICE" BOARDS.

the public rooms, corridors, &c., are on "L.C.C." or "Police" boards connected directly to the Company's supply links, and so independent of the other lighting circuits. Thus half the lamps in every public portion of the building are on the theatre main and half on the other, and there is no danger of panic from a supply failure. The power circuits are divided over the two mains also. Fig. 4 shows one of the main lighting switchboards and the Supply Company's main board on the right; Fig. 5 shows the other main lighting board and one of the "Police" boards.

(To be concluded.)

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION

THE Annual General Meeting was held at the Institution of Electrical Engineers on Thursday and Friday, June 17th and 18th. Mr. A. C. Cramb, Acting-President, took the chair.

The CHAIRMAN, in opening the proceedings, said :—"When we assembled in Birmingham last summer for the 1914 Convention we little thought that within a few weeks this country would be engaged in this most terrible war. It is inevitable, of course, that our thoughts and energies must be, to a very considerable extent, occupied with the carrying on of the war and doing all we can to push it forward to a successful conclusion. It has also had certain results on the work of this Association. Firstly, your President, Major Richardson, was called up for active service early in the autumn, and it was found that he would not be able to take part in the deliberations of the Council; your Council appointed me as Acting-Chairman in Major Richardson's place in his absence. At the end of the year, when it became evident that the war would not be over by the summer, the Council had to consider what course should be adopted with regard to holding the Annual Convention this summer. After careful consideration, it was decided that as by the bye-laws of the Association we have to have an annual meeting each year, a meeting should be held in London, but that all social engagements and visits on this occasion should not take place, and further that the visitors' list should not be issued. I feel sure that this decision will meet with your approval in the circumstances. With regard to visitors, the co-opted members of the Vehicle Committee and Development Committee have been invited to take part in the discussions to-day, and I think I ought to take this opportunity on your behalf of thanking these gentlemen for so kindly taking part in the work of these two Committees, and giving their valuable time and experience to furthering the objects for which these two Committees have been established."

The report, given in slightly abbreviated form below, was then presented, the authors explaining, in an introductory note, that, had it not been for circumstances arising out of the war, the review of what had been done by the stations having a "point-five" tariff would have been more complete.

THE PRACTICAL RESULT OF THE POINT-FIVE TARIFF

By A. S. BLACKMAN (*Chief Electrical Engineer, Sunderland*) and THOS. ROLES (*Chief Electrical Engineer, Bradford*).

The following is a list, in chronological order, of the undertakings which have adopted the "Point-Five" Tariff, with the dates upon which it was put into force :—

Poplar (1909), Southampton (1910), Luton (1910), Bradford (1910), Sunderland (1912), Barnes (1912), St. Marylebone (1912), York (1912), Carlisle (1912), Wrexham (1913), Accrington (1913), Sheffield (1913), West Hartlepool (1913), West Ham (1913), Wolverhampton (1913), Ilford (1914), Blackpool (1914), Wakefield (1914), Worcester (1914), Ipswich (1914), Leeds (1915), Chester (1915).

To the Poplar electricity undertaking belongs the honour of being the first to adopt such a tariff, in Feb., 1909, although this fact was not generally known until the formation of "The Point-Fives" Association. The fixed charge at Poplar is varied in accordance with the kw. installed for lighting, heating, cooking, &c. [see a Paper by Mr. H. Bowden (*ELECTRICAL ENGINEERING*, Vol. X., p. 363, June 25th, 1914)], and includes a service charge, and, in some cases, charges for the hire of wiring and consuming devices. Southampton makes the granting of a halfpenny rate for heating and cooking conditional upon the consumer installing a certain minimum number of lights charged at ordinary lighting rates. Luton supplies current for heating and cooking purposes at a flat rate of one-halfpenny per unit without any fixed charge. Bradford confines its Point-Five Tariff to domestic premises, and bases it on the "Norwich" or rateable value system, and practically the whole of the undertakings which have since become converts to the Point-Five principle have adopted this system.

So far as the writers are aware, the two methods cited above of arriving at the fixed charge are the only ones which have been adopted, and the difference between these methods is but one of convenience in the working of the tariff. The fixed charge per kw. is more strictly correct in individual cases, whereas the apportionment upon the size of the house

is an average result which has been found to be a sufficiently close estimate for all practical purposes, and to possess the advantage of uniformity and simplicity; any other readily available basis might be adopted, as, for instance, the cubical capacity of the premises or the total floor area. In most towns in which a Point-Five Tariff, based on the rateable value system, has been instituted, it is restricted to private houses, as it does not so readily lend itself to the more widely varying conditions of other classes of supply. The percentage of the net rateable value decided upon varies, in different towns, between 10 and 15 per cent. per annum, the amount generally being apportioned between the four quarters of the year, sometimes equally and sometimes in approximate proportion to the lighting hours, as, for instance, one-third for each of the two winter quarters and one-sixth for each of the two summer quarters. In Sunderland the percentage is varied between 10 per cent. for a house rated at £30, to 15 per cent. for a house rated at £70 and upwards, because a large house generally furnishes the worse load factor.

Both writers have obtained their experience under the rateable value system, but it does not follow that the system would be equally successful in other towns. Both in Bradford and Sunderland the tariff has been left to justify itself, and no scheme of hiring out heating and cooking apparatus is in existence.

A discretion should be exercised in favour of the consumer who, in consequence of living in a house with an abnormal amount of ground attached to it, is rated out of proportion to the size of the house. In Sunderland the Rating Department have simply been asked to say how much of the rateable value could properly be apportioned to the excess of ground over and above a normal allowance, and such amount has been deducted in fixing the charge. In Bradford, on the other hand, the Rating Authorities, when approached, have only deducted a sum from the total equal to the rateable value of the surrounding land as it would be assessed if used for agricultural purposes, and state that they cannot say what increased value can be put upon the land by reason of its being attached to the house. It follows, therefore, that a reduction made on these lines is insufficient, and if, therefore, cases arise in which this point has to be decided, the practice adopted will probably be to base the fixed charge on what is being paid for houses of similar size with a normal allowance of land.

A marked advantage of the rateable value basis is the facility with which an accurate estimate of a consumer's bill can be prepared; a wide error may be made in assuming the number of units, and the estimate still remain reasonably correct. This has been found very useful to the canvassers in towns where a cheap supply of gas has to be competed against.

Numerous other advantages have attended the adoption of a Point-Five Tariff based on the rateable value system :

Under the ordinary flat rate for lighting purposes residential consumers often only introduced electric light into the best rooms, leaving the servants' quarters, &c., which possess a better load factor, illuminated by gas. On the rateable value basis, however, once the fixed charge is assessed, all current required for lighting, as well as for heating and cooking purposes, is supplied at the low price of one-halfpenny per unit, and consumers, therefore, light the whole of their premises electrically. Carelessness in leaving lights burning unnecessarily does not unduly inflate the accounts. Moreover, under a flat rate the lighting of most houses compared unfavourably with that of houses illuminated by gas, especially when the mantles were kept in good condition, for, on the score of economy, lamps of only small candle-power were generally in use. The low charge per unit on the rateable value system has resulted in consumers using lamps of considerably higher candle-power. It is now usually quite easy to determine whether or not a house is on the Point-Five Tariff by the brilliancy of the light proceeding from the windows. It may, of course, be argued that the additional maximum demand caused by this increase of light must adversely affect the supply undertaking. Against this must be put the fact that, owing to the houses being almost invariably wired throughout, the diversity factor of the installations is higher, which tends greatly to increase the load factor of this class of supply.

No additional charges can be made against the increased amount of lighting on account of services or distribution mains, as the cables used for these purposes are generally standardised to two or three sizes, and the cost of trenching, cutting away of walls, &c., is practically independent of the size of cable used. The additional expenses to the under-

taking consist of the cost of increasing the capacity of the generating plant—which can now be done at far cheaper rates than in the days when the flat rate for lighting purposes was decided upon—and the provision of extra feeder cables. No additional management charges can be debited against the extra lights, as whatever the size of the installation the cost of service inspection, meter reading, rendering of accounts, and general management of the undertaking is practically the same.

It is, of course, possible that the increased capital expenditure incurred on new plant and feeders causes a reduction in the profits, but the writers' experience is that any such reduction from a limited number of consumers is soon far more than counter-balanced by the profits derived from the additional consumers gained by reason of the excellent advertisement of the improved lighting. In both Bradford and Sunderland it has been found that the majority of new domestic consumers adopt the rateable value tariff; houses are, as a rule, wired from cellar to attic; the domestic load factor has improved; the illumination of rooms has in almost every case been considerably increased; and no complaints are now received as to the inefficiency of electric lighting as compared with lighting by means of gas. Since current has been supplied at one-halfpenny per unit, not only has the number of electric heaters increased to a tremendous extent, but the capacity of the individual heaters has also increased, so that in several Point-Five towns the 3 kw. radiator has become a standard. The air temperature of the rooms is kept practically constant throughout, and the occupants are under no necessity to remain within the direct rays of the heaters.

From the point of view of the preparation of this Paper it is unfortunate that the electricity supply undertakings under the management of the writers are both situated in industrial towns, so that the house supply load is not of chief importance. In Bradford the units sold to private houses are only 8 per cent. of the total sales, and in Sunderland 2·6 per cent.

Bradford Results.

At December 31st last, 1,298 private house consumers were connected to the supply, whereas prior to the introduction of this method of charging on July 1st, 1910, the number of such consumers was but 511, representing the result of nearly twenty-one years' working. Thus, during the 4½ years the Point-Five Tariff has been in force, the number of domestic consumers has increased by over 150 per cent. More than half of these consumers have elected to be charged on the special rate, the houses being in practically all cases electrically lighted throughout. Owing to changes of tenancy and alterations in other conditions, the comparison given below relates to only 138 of the consumers changed over, the periods covered being the year prior to the introduction of the Point-Five Tariff and the year ended December 31st, 1914.

Based on the total kw. installed, the average load factor of the 138 consumers increased from 3·38 to 4·34 per cent. The units sold increased from 93,880 to 182,872, the revenue decreased from £1,566 to £1,358, and the average price from 3·98d. to 1·78d. per unit.

The following table applies to consumers supplied under the flat rate of 4d. per unit and under the Point-Five Tariff respectively, the comparison applying to all domestic consumers connected for the complete twelve months ended December 31st last:

| Tariff. | Number of Consumers. | Average | | | Average revenue per house. £ s. d. |
|---------|----------------------|-------------------|----------------------------|------------------------|------------------------------------|
| | | Total units sold. | number of units per house. | Total revenue. £ s. d. | |
| 4 | 340 | 124,742 | 367 | 2,005 | 5 18 0 |
| 0·5 | 566 | 612,502 | 1,082 | 4,312 | 7 12 4 |

A comparison of the diversity factor in the residential areas shows an increase from 2·65 for the year ended June 30th, 1910, to 2·94 for year ended December 31st, 1914, but since the introduction of the Point-Five Tariff a considerable amount of heating apparatus has been connected in private houses without the Electricity Department being notified, so that the diversity factor is actually undoubtedly greater than 2·94. The kw. installed from which these diversity factors are calculated were 420 at June 30th, 1910, and were almost exclusively for lighting. The number of consumers affected was 233, making an average of 1·8 kw. per house. At December 31st, 1914, the consuming devices in connection with the installations in these areas had increased to 853 kw., and the number of consumers to 367, giving an average of 2·32 kw. per house. Of the 853 kw., 545 were for lighting and 308 for heating and cooking purposes, the average per house being 1·48 and 0·84 respectively.

The annual percentage of the rateable value debited to a

consumer in Bradford adopting the Point-Five Tariff is 15, and it is estimated that this, coupled with a charge of one halfpenny per unit, brings in a revenue equivalent to what would be earned for an average supply of current for lighting purposes at a flat rate of 4d. All energy required for heating and cooking purposes is thus obtained at the halfpenny rate.

Although in Bradford domestic consumers have not been approached individually for the purpose of explaining the advantages of changing over to the Point-Five Tariff, more than half have elected to be charged on the latter system, and have introduced heating or cooking apparatus. This is all the more remarkable because no general attempt has been made to induce consumers to instal heating and cooking apparatus, the staff of the business-development department having been fully occupied in dealing with power supplies.

In addition to this, an agreement has been in existence between the Gas and Electricity Departments that in thoroughfares in which electricity mains are already laid the Electricity Department's canvassers shall not call upon gas consumers with a view to persuading them to take an electricity supply. Furthermore, the Gas Department have been exceedingly active during the past few years in advocating the use of gas for heating and cooking purposes.

A letter from Mr. P. Collinson, the Honorary Secretary of the Bradford Branch of the Electrical Contractors' Association, quoted in the Paper, expresses decided approval of the Point-Five or "Domestic" tariff.

Sunderland Results.

At the introduction of the Point-Five Tariff there were 337 private houses connected to the supply, the majority partially lighted only, as the result of sixteen years' working. Since the tariff was introduced on January 1st, 1912, three years' working has resulted in 162 more private houses being connected; 100 of these elected to be put on the Point-Five Tariff and are lighted throughout, and 62 upon a flat rate of 3·6d. per unit. Of the 337 houses that were on the supply at January 1st, 1912, 105 have changed over from the flat rate to the Point-Five Tariff, and of these 87 have, owing to there being no change of tenancy, been taken for the following comparison, the periods being the year preceding and the year following the adoption of the Point-Five Tariff.

The average of consumers' load factor on kw. installed increased from 2·44 per cent. to 4·05 per cent. The units sold increased from 44,827 to 93,327; the revenue decreased from £672 to £616, and the average price from 3·6d. to 1·58d.

For the purposes of comparison it must be remembered that the units and money values under the old tariff refer almost entirely to carbon lamp conditions. Our experience with pure lighting installations that have remained upon our mains unaltered over a term of years, save for the transition from carbon to metal filament lamps, shows that for purposes of comparison under modern conditions the average units consumed per house under the old tariff might be corrected to 354 instead of 512, and the average revenue per house £5 5s. 9d., instead of £7 14s. 5d. Making this adjustment, the following comparison is arrived at:

| Tariff. | Number of Consumers. | Total units sold. | number of units per house. | Average revenue per house. £ s. d. | |
|---------|----------------------|-------------------|----------------------------|------------------------------------|------------------------------------|
| | | | | Total revenue. £ s. d. | Average revenue per house. £ s. d. |
| 3·6 | 212 | 75,032 | 354 | 1,121 | 5 5 9 |
| 0·5 | 286 | 298,563 | 1,044 | 1,803 | 6 6 11 |

The average size of the houses in these two groups is about the same, so that the heavier unit consumption under the Point-Five Tariff is in no way attributable to larger houses.

The maximum load on the residential areas increased from 141 to 227 kw., the kw. installed in private houses from 461 to 1,152 kw., and the corresponding diversity factor from 3·25 to 5. In the earlier period, the 461 kw. connected, was almost exclusively for lighting, averaging 1·36 kw. per consumer; in the latter period the corresponding figures were 650 kw. (1·3 per consumer) for lighting, and 502 kw. (1·09 per consumer) for heating and cooking.

An interesting set of tables, compiled from information obtained from "point-five" stations, was attached to the Paper. In thirteen of the seventeen stations referred to in the tables the rateable value system is adopted for the fixed charge, the percentages varying from 10 to 15 per cent., and some of them introducing a sliding scale. In York, the tariff is not of the simple "point-five" order; the fixed charge is 10 per cent. of the rateable value, and the first units consumed are charged at 1d. up to 75 per cent. of the fixed charge and then at 1d. St. Marylebone calculates the fixed charge at £18 13s. 4d. per kw. of maximum demand for lighting, assuming the maximum demand to be 70 per cent. of the watts installed, "less convenience lights." In Southampton for the period to which the returns apply no fixed charge was made, the Point-Five Tariff being "flat."

The load factors on networks supplying residential neighbour-

hoods show good increases, since the introduction of the Point-Five Tariff, the records being held by St. Marylebone for an increase from 16·9 to 21·4 per cent., Wrexham from 17·3 to 20·9 per cent., and Sunderland from 11·46 to 18·76 per cent. These relate to the whole load on these networks, and not merely to those consumers who have been changed over to the new tariff. A comparison of the number of units per house per annum on the old tariff with the number per house on the new tariff makes it clear that the consumers who have adopted the latter understand its import. Thus in Wrexham 43 houses consume on an average 24,234 units each under the old tariff, and 45 houses an average of 44,383 units each per annum under the new tariff. In Bradford the 340 houses on the old tariff consume an average of 367 units each per year, and the 566 on the new tariff an average of 1,082. At Blackpool only twelve houses have so far adopted the Point-Five Tariff and consume an average of 4,280 units each per annum, while those on the alternative tariff, numbering 2,858, consume on an average 700 units. In reply to a question whether any difficulty has been experienced owing to the increased load on the mains, seven out of fifteen stations say "no," and two reply that slight difficulties have been experienced, but West Ham reports that several cooking consumers have been the cause of expensive mains extensions.

Undertakings having powers to hire out cooking and heating apparatus have been particularly successful with the extensions of their load in this direction, although we note that the rental charge is sometimes a higher percentage of the capital cost. Carlisle bases it at 20 per cent., St. Marylebone 30 to 35 per cent., Southampton 25 per cent., West Ham 20 per cent., Wolverhampton at an average of 15 per cent., and York stands alone at 10 per cent.

The last table of the series relates to Southampton, the town with the flat Point-Five Tariff. From March 31st, 1910, to March 31st, 1915, the total connections increased from 2,759 to 8,085 kw., but the increase in the diversity factor was such that the maximum load increased only from 1,670 to 3,091, and the increase in units sold from 1,622,559 to 5,159,671 shows that the load factor also improved greatly. It is interesting to note also that, out of the 5,159,671 units sold last year, 1,290,442 were for heating and cooking, while in 1909-10 the proportion was only 13,361 to 1,622,559.

The Paper was read in abstract by Mr. Roles, after which the following remarks were added by Mr. Blackman.

Mr. BLACKMAN, referring to the great reduction in the average price per unit resulting from the point-five tariff, said that so far as he was personally concerned, it had not been his ambition to sell electricity exceedingly cheap; it had been very largely a question of either reducing the rates or else losing the business to competitive illuminants and methods of heating. He had before him a rough estimate of the cost of supplying the house load in Sunderland. These figures were based upon existing plant, which carried with it very heavy capital charges in comparison with what could be done in extensions to-day, so that if he could make out a case under existing conditions he had a very good case indeed when it came to future extensions. The annual charges for interest and sinking fund upon the works plant in Sunderland amounted to £1 9s. 2d. per kw. per annum, and taking a diversity factor of 20 per cent. this gave an annual charge of 1s. 5½d. for works plant to meet this domestic load. The extra high tension feeders and sub-station equipment worked out to 11s. 7d., and taking a diversity factor of one in ten, this gave 1s. 2d. per annum. With regard to low tension feeders and networks, which he had gone into very carefully by putting demand indicators in pits controlling certain areas, he took a diversity factor of one-fifth which gave 10s. 4d. That was the heaviest item, and the total came to 12s. 11d. annual charges per kw. Electricity on a 18 per cent. load factor was at present being turned out at 0·13d. per unit, and this gave a total cost per unit of 0·247d., say a farthing. So far from considering that he was on his defence in making out a good case in supplying at ½d. per unit, he was absolutely convinced that ½d. was no good in the northern towns, at any rate for heating load. It was all right for cooking, but for heating it was altogether too expensive, and in the development of the Point-Five tariff there were two alternatives. One would be to keep the fixed charge as at present and supply, in the case of a £40 a year house, the first three thousand units per annum at ½d. and all additional units at ¼d.; and the other alternative would be to give the consumer the option of paying a higher fixed charge, and supplying the whole of the units at ¼d. So far as he was concerned the adoption of one of these two methods was likely to be the trend of events.

Discussion.

Mr. G. WILKINSON (Chief Electrical Engineer, Harrogate) regretted that the Paper should have been presented by two members whose proportion of private residence consumers was very small. At Bradford and also at Sunderland there had been an increase in sales in the order of 100 per cent., but a drop in revenue. If these had been the only towns given in the Paper it would be very depressing indeed, but the tables

at the end showed that the revenue from other towns had substantially increased at the same time as the sales. At Harrogate they had to live largely upon residence business, and he had analysed no less than 918 private residence accounts which were supplied at 6d. and 2d. On this basis these private houses produced £5,702, but taking the Point-Five tariff and a 15 per cent. rateable value, this revenue would have increased to the substantial sum of £7,572, or say £7,000 after allowing for the grounds belonging to the houses. This showed that a rateable value system might be a really sound proposition. There was no doubt, however, that the consumer who would not benefit by it would not take advantage of it, and therefore, for the time being, the undertaking must suffer. It would be counterbalanced ultimately by the extra current taken, and the temporary slump might be largely guarded against if a condition were incorporated that anybody adopting the tariff must put a certain percentage of other devices into their premises before they would qualify. With regard to the increasing use of radiators, there was very little doubt that an immense amount of damage had been done by putting in radiators which were much too small for their rooms. It was satisfactory to know that in the Point-Five districts radiators were being very much increased in power, but this necessarily entailed some method of regulation. It was absurd to expect people to pay ½d. per unit for water heating. It was possible to obtain apparatus which would give a 100 per cent. load factor and consume ½ kw. continuously for which supply could well be given at ½d. per unit, or 4d. per day. This would compare well with other methods. It should provide a household with sixty-five gallons of water per day raised from 50° to 100° F., and under normal conditions in a small household he contended that this was ample. In this matter of the electrical equipment of the household, a factor which should be put in the equation was the saving of domestic labour.

Councillor SYMONDS (Hereford) said that it was an exceedingly dangerous doctrine to put forward without reservation that it was a good thing to cultivate a heating and cooking load. In Hereford, for instance, the upper-class residential houses were in districts quite separate from each other and at considerable distances from the centre of supply. Again, these houses were all late dinner houses; the cooking load would come on top of the lighting peak. The cable which supplied his own house ran 2,400 yards from the nearest feeding point. There were forty-one consumers on that cable, and if all were to take current for cooking it would be necessary to treble the cable, and in nearly all cases to double the services. The Gas Department at Hereford had 2,500 cookers and, in a town of only 22,000 inhabitants, 600 gas fires, and therefore the Electricity Department would have to do better than making an ordinary working profit before it could justify to the Council any such action. In addition to this, such districts were liable to grave difficulties in maintaining the pressure. If he were provided with a frying-pan, a rasher of bacon and a stop watch, he would undertake to tell the pressure at the station within 3 per cent. of accuracy. It had happened during the past winter that the ruler of his house had told him that the volts at the station were down because she could not cook the breakfast, and by checking them on the recording meter he had found that the pressure was down 7 volts. Councillor Symonds then proceeded to criticise the Point-Five tariff. At Bradford, where the lighting load was insignificant, it did not so much matter that the consumers who had taken this system up had been presented with 89,000 units, and in addition had been given a cash bonus of £177, but it really did not strike him as business. Only one place was apparently realising a profit, and that was Marylebone, which obtained 1·6d. per unit, and it was significant that Marylebone was the only one which had not adopted the rateable value system, but had the kw. demand system. With the rateable value system they would be charged with giving undue preference. He had taken two Hereford consumers as an example who at present each paid about £14 a year. On the basis of 15 per cent. on rateable value and ½d. per unit, one would pay £8 and the other £20. The only plea raised for rateable value was that they must have something the consumer could understand. He differed. What was wanted was something the consumer thought he understood, and he would undertake to make any consumer think he understood the maximum demand system within five minutes. Lastly, a tariff should apply to all consumers alike, and for this reason he was in favour of the kw. demand charge and so much per unit, as this could be applied to business premises just as well as to private premises.

Mr. C. H. WORDINGHAM said that when, in 1893, the Hopkinson system of charging was introduced in Whitehaven and Manchester the argument which he found was effectual was, "wait and see when your bill comes in, and you will find how much less it is on this mysterious method than on the flat rate." His words were usually justified. He did not find the most difficult people to be convinced to be the consumers; he found the members of the Committee were much more thick-headed. People were now re-discovering the Hopkinson system. Not many years ago they found men like Handcock and Dykes re-discovering it with a tremendous flourish of trumpets as a great novelty; they seemed to think it had something to do.

with metal filament lamps. And now the Point-Five Association had re-discovered it, although they had mutilated it worse than anybody else had. He disagreed entirely with the rateable value system of charging. He contended that it was essential to have fixed charges which bore a proper proportion to what the fixed charges cost, and there must be a revenue which had a proper proportion to what the running charges cost. Then the fixed charge per kw. plus a charge per unit was the only sound system of charge which should be adopted in all towns of the kingdom. He did not believe for one moment that it was possible to heat water, as Mr. Wilkinson had suggested, economically in sufficient quantities for ordinary domestic supply, and he firmly believed that the cause of electric supply was damaged by statements of that kind. He did not believe that in practice it could be done, and it was a great mistake to try to do it, or to say it could be done.

Mr. W. W. LACKIE (Chief Electrical Engineer, Glasgow) said that the report bore out what was shown by the Paper read at last year's Convention by Mr. Bowden, viz., that energy was not supplied at 0'5d., but rather at something like 1'5d. per unit. In both Sunderland and Bradford he noticed that the effect of the introduction of the Point-Five tariff had been to reduce the revenue per house. In fixing the Glasgow domestic tariff his main endeavour had been to see that the revenue per house was increased and not diminished. If a consumer was paying £5 per annum for lighting his house, he got excess units over this at 3d. without the necessity of having an additional meter and separate wiring. Their charge for a £40 house was 3d. per unit for the first 200 units per annum and 3d. thereafter. The 200 units were allocated *pro rata* to hours of darkness over six two-monthly periods. In his own house the charge was 300 units at 3d. and all over at 3d. The total annual consumption was about 1,500 units, giving an average price of 1'2d. per unit. There were in Glasgow 10,000 domestic consumers, and 2,300 of these had adopted the proposal put forward and had taken 600,000 units for heating and cooking purposes. The 2,300 consumers who had installed heating and cooking apparatus had increased their domestic consumption from 500,000 to 1,100,000 units. The principal matter of interest from a domestic point of view in Glasgow, however, was that fully a year ago an enterprising builder started the erection of a number of houses and equipped them electrically throughout. There was one ventilator to each house in place of a chimney. Heating, cooking, and lighting were all done entirely electrically. No coal or other fuel was allowed inside any of these houses. One of the houses had been occupied for a year by the builder himself. The units used were 16,000, and the total bill £51 8s. The average price per unit worked out at 0'77d. This was for a house of five apartments, and the occupier expressed himself as being quite satisfied. Some years ago the question of power factors, load factors, and diversity factors was looked into, and in a town near Glasgow, which is entirely residential, it was found that the ratio of maximum demand on the station to lamps installed in the houses was 1 : 5. A large block of tenements in the West End of Glasgow was taken, and there it was found that the ratio of maximum demand on the feeders supplying the block to the lamps installed was 1 : 6. This, he did not think, confirmed the diversity factors of 2'6 and 2'2 given in the Paper.

Mr. H. W. BOWDEN (Borough Electrical Engineer, Poplar) said he was a great advocate of the Point-Five system, and thought it was absolutely right, but joined issue with the authors upon the question of assessment. It seemed to him that it was no more difficult to arrive at a true fixed charge, taking the amount of radiators, heaters, lamps, etc., installed, as leaving the whole thing to another department, who knew nothing at all about the assessment on an electrical basis. The only advantage that the rateable value could claim, in his opinion, over the proper fixed basis, was that of simplicity. He favoured the system described in his Paper last year, and quoted figures to show that its result was increasing profits. Poplar was the only undertaking in the country that had been able to reduce prices since the war broke out; for domestic supply they had reduced the prices practically 25 per cent. During the last two years Poplar had put by a certain amount out of profits, and was now prepared to send out small apparatus, such as fans, irons, and radiators, free of charge in order to create that load. He did not agree with the authors that it would not be necessary to increase the charges on account of services, because when cookers were put in it invariably necessitated larger services, especially if the apparatus were 5 or 7 kw. Up to a point he was inclined to agree that the management would not be increased, but if the thing extended to any large degree there must be increased management charges after a certain period.

Baillie STEVENSON (Edinburgh) said he was not a convert to the Point-Five tariff, and put forward one or two objections to it from a convener's point of view.

Alderman SMITH (Barrow-in-Furness), replying to the criticisms of Councillor Symonds, said that it was not the big houses that came on first for electric cooking, but the middle-sized houses, and the question of increased cost of mains did not apply to them with the same force. The bulk of people in these houses had their dinners at mid-day, and they did

not all have hot dinners on the same day. It was in the smaller houses, where the wife did most of the cooking herself, that electric cooking was more likely to be adopted and appreciated.

Mr. R. A. CHATTOCK (Chief Electrical Engineer, Birmingham) said that industrial towns began with a lighting load and put forward low tariffs for power supply. They were criticised, but the low power rates had justified themselves. In some of these industrial towns the lighting supply was, in fact, becoming a by-product, and they could afford to charge low rates for lighting, and attract a heating and cooking load in the same way that they built up their power business. But residential towns must feel their way very gingerly, or else they might be faced with a loss for some years.

Mr. W. H. COOKE (Chief Electrical Engineer, Luton) said he did not believe in the rateable value system; it was not equitable. The rateable value of a house had nothing whatever to do with the consumption of electricity in that house. In Luton there was a simple flat rate of 3d. per unit for heating and cooking purposes. He had considered, first, whether heating and cooking would stand a higher charge, and his conclusion was that it would not. Moreover, he had found that 3d. would very well include capital charges. One great objection he had to the rateable-value system was that it could not be supplied to business premises, and the heating load of business premises was equally as valuable as the heating and cooking load in domestic premises. In the returns given in the paper, the largest number of units given for domestic purposes was 185,000, at Bradford. In Luton, which was a very much smaller town in population than Bradford, they had sold about that same number for domestic purposes, and, in addition, nearly half a million units for business premises. This did not refer to industrial heating, but power for heating business premises and offices, and this load was obtained because it was supplied at 3d. per unit. Last year there was a considerable increase in the output; 85 per cent. of that increase was due to the units which were sold at and under 3d. per unit, and they had made very much larger net profits than were made in previous years. It was absolutely essential to have a hire system in operation for heating and cooking purposes, because of the high price of the apparatus.

Councillor CROWTHER (Sheffield) said he was a strong supporter of the rateable-value system. For something like seven years he was on a flat rate of 4d. for all purposes, but at the first opportunity he went over to the rateable-value system. Immediately his all-round cost went down from 4d. to something like 1d., and taking the average of a number of houses in large towns with a rateable value of £25, the cost worked out to about 1d. per unit. For houses of £30 rateable value, it went up to 1d., and at £40 it went to 1d., so that the larger the house the higher the cost. This, however, was an absolutely fair principle, and it had been recognised for several years in connection with water supply. Some allowance should be made in those cases where large grounds were attached to the houses.

Mr. A. NICHOLS MOORE (Chief Electrical Engineer, Newport, Mon.) said that at Cardiff last year, with a 1d. flat rate for heating and cooking, the revenue was increased from £615 to £1,083, and in Newport the units for these purposes had been increased from 77,000 to 166,000, and the revenue from £280 to £692. The total number of heaters had jumped from a matter of dozens to 300, and with cookers they had now made a modest start of 26. So much for the question that it was impossible to do anything except with a 3d. tariff. If the average price obtained was rapidly decreasing, and the percentage of the working costs to the total receipts were shown to be a steadily increasing quantity—with capital expenditure going on all the time—then, with the percentage of gross profit also rapidly decreasing as a sequence, there was something wrong about the financial condition of such an undertaking. He had been led to that thought by Mr. Roles' figures; his revenue had actually decreased by £208, and he had actually spent £100 in getting those units on the basis of 3d. per unit, making a total adverse balance of £308. Taking Luton, Southampton, York, Carlisle, and Marylebone, the average decrease in price received since the adoption of the Point-Five tariff was 39 per cent. The percentage of works costs to revenue received had risen by 13'5 per cent., whilst the percentage of gross profits to total revenue, which was only 42 per cent. originally, had dropped by 10'5 per cent. Against these he put the case of Norwich, Nottingham, Leicester, Brighton, and Mansfield, which had not adopted the Point-Five tariff. The average decrease in price during the same period of these undertakings was only 8'5 per cent., the percentage of works costs to revenue had only increased by 5'5 per cent., but the percentage of gross profit to total revenue had only decreased by 3 per cent., as against 10'5 per cent. in the other instances.

Mr. F. M. LONG (Chief Electrical Engineer, Norwich) said that with coal costs at 0'17d. per unit as at Sheffield, it was easy to see that current could be supplied at 3d. per unit, but when the coal was costing 0'56d. per unit, as at Ilford, it was quite a different matter, and there should be some explanation as to how a Point-Five tariff was justified in such cases as that.

Councillor JONES (Kilmarnock) said that in Kilmarnock they

had been working on the rateable-value system, but their experience had not justified their original firm belief in it.

Mr. Roles and Mr. Blackman then replied briefly to the discussion, Mr. Blackman remarking that it had rather gone to exemplify the truth of the old saying that any case could be killed with talk.

THE USE OF ELECTRIC VEHICLES IN MUNICIPAL SERVICE

By F. AYTON (Hon. Secretary to the Electric Vehicle Committee.)

THIS Paper is a report presented by the Electric Vehicle Committee. It is remarked at the outset that there could hardly be conceived a more suitable field for the employment of the electric battery vehicle than that connected with municipal service, because the work lies entirely within the sphere of short-distance haulage at moderate speeds. The mileage capacity per charge, i.e., 35 to 45 for the heavier vehicles, is sufficient for practically every duty which the municipal vehicle has to perform, and, by a midday boosting charge, may be considerably increased. The main reason for urging the adoption of electric vehicles by municipalities is the economy which attends their use in substitution for horse haulage. In support of this contention, attention may be directed to the experience of Glasgow—where the Electricity Department found that their first electric van, of 1-ton capacity, did the work of two horses at a saving in expense and with greater efficiency, while, compared with the petrol van, the electric did the same work with a saving in the neighbourhood of £240 per annum. Other evidence is afforded by the refuse collection trials at Barnes and at Heston and Isleworth, while the case of Calgary, the daily saving, as against horses, by the operation of two electric

a half-ton or one-ton van for delivering meters, transporting materials to the service and mains-laying gangs, and in other like duties. And in the larger undertakings good use may be made of a small electric car for the business rounds of the engineer, the mains superintendent, or the sales manager.

Delivery vans are now in use or on order by the Electric Supply Departments at Glasgow, Edinburgh, Derby, West Ham,

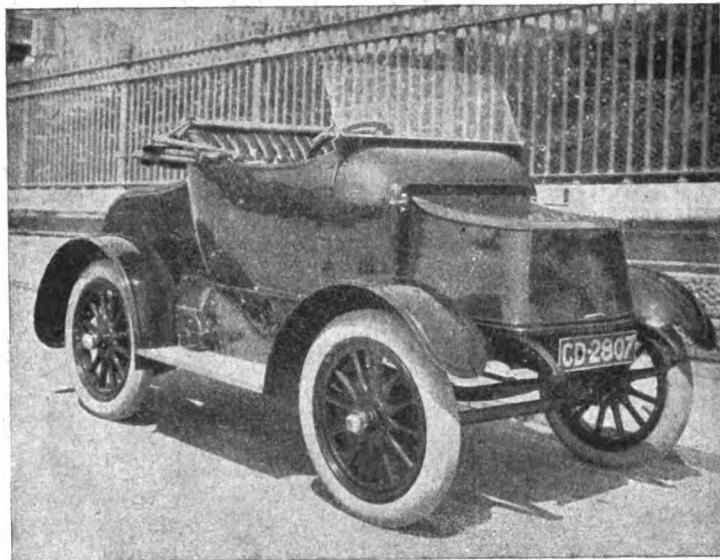


FIG. 2.—THE BRIGHTON ELECTRIC SUPPLY DEPT. ELECTRIC CAR.

Croydon, Blackburn, Bootle, Hereford, Ipswich, Grimsby, Brighton, Wolverhampton, Southampton, Liverpool, and the Borough Councils of St. Marylebone, Stepney, and Poplar. The one-ton Edison van used by the Glasgow Electric Supply Department has been in constant use since August 6th, 1913, and up to April 28th, 1915, had covered a total mileage of 22,284 with an energy consumption of 13,752 units, including battery losses, or 0·62 unit per mile; and the Department has ordered a half-ton and a one and a half-ton vehicle for delivering material from the general store, and a three-tonner for mains work. The vehicle at Brighton is a two-seater car used by the Engineer and Manager of the Electric Supply Department for business purposes. Its speed is about 16 miles per hour on the level; weight, 22½ cwts.; average daily mileage, 25; while the energy consumption is about 0·5 unit per mile input to battery. At 1d. per unit this is only about one halfpenny per mile. The vehicle has run close on 1,000 miles at the time of writing, and, so far, beyond the cost of cleaning, it has cost nothing for maintenance, the tyres showing little or no signs of wear. The battery is of Tudor make. The West Ham Electric Supply Department's one-ton Edison battery vehicle, which took part in the electric vehicle parade, was described and illustrated in our issue of last week.

The St. Marylebone Electric Supply Department van was also

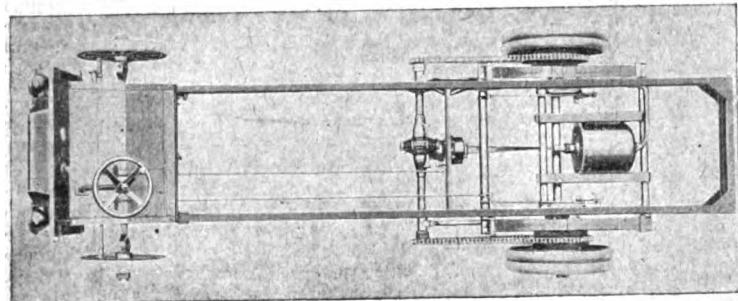


FIG. 1.—TYPICAL ELECTRIC VEHICLE CHASSIS SHOWING THE SIMPLICITY OF THE MECHANISM.

watering and flushing vans, is given as about £5. Outside municipal service we have the case of Harrod's Stores, who run 55 delivery vans, and give as their reason for adopting the electric vans: "We find them cheaper than horses."

The durability of the electric vehicle is such that there is justification for putting the average life of a modern vehicle of good make at not less than ten years. In the United States electric commercial vehicles built twelve years ago are still in daily service. Reliability is another feature, for experience has shown that this type of automobile can keep the road day by day for more days in the year than any other type. The reasons for this are the simplicity of the mechanism, the strong construction, and the fact that any repair or replacement can usually be effected during the night, or in such a short time as not to interfere with the use of the vehicle. The introductory portion of the Paper dwelt further on the hygienic advantages of electric vehicles, the fact that 70,000 are in use in America, and, in the case of municipalities that own electric supply undertakings, there is the important new source of revenue which the general use of electric vehicles in any district will open up, the demand in connection with which need never come on during "peak-load" hours.

The Electric Supply Department.

It is necessary that a department hoping to induce the adoption of the electric vehicle in its territory should itself set the example. Apart from its advertising value and its usefulness for giving demonstrations, the electric vehicle has many other advantages. For breakdown work it is ready to go out at a moment's notice, and is so simple that several of the mains staff may be taught to drive it. There are few undertakings of reasonable size that could not make use of



FIG. 3.—THE ELECTRIC VAN OF THE IPSWICH ELECTRIC SUPPLY DEPARTMENT.

described and illustrated in our columns in connection with the parade.

The vehicle of the Electric Supply Department at Wolver-

hampton is used for delivering goods, as well as to take men and their tools on to jobs. The energy consumption is 0·74 unit per mile input to battery, and the speed about 12 miles per hour. The Department has on order a 2½-ton vehicle for the removal of clinker and ash from the power station. The Ipswich vehicle (Fig. 3) has a total weight of 34½ cwts., a speed on the level of about 12 miles per hour, and an energy input to the battery of about 0·7 unit per mile. The vehicle is used for delivering the goods of the Installation Department, and is also employed by the Mains Department. The vehicle belonging to the Croydon undertaking is a two-seater run-about fitted with an Edison battery. The car is used by both the Distributing Engineer and the Sales Superintendent, and during the five months the expenditure in repairs and general upkeep has been nil. The total mileage covered in this period has been 2,156, or an average of 24 miles per day. The Borough Electrical Engineer, Mr. A. C. Cramb, gives the following costs of operation :—

Running Costs.—Energy (at 1d. per unit), 0·510d.; oil and grease, 0·007d.; washing, cleaning, &c., 0·388d.; tyres (£35 per set for 5,000 miles), 1·660d.; total running costs, 2·565d. per mile.

Depreciation.—Battery (5 years), 1·600d.; vehicle (10 years), 1·620d.; total cost per mile, 5·785 pence per mile.

Besides their use for delivering goods, answering "breakdown" calls, and carrying the supervising officials about, there are other ways in which the electric vehicle may be made use of in the service of electric supply undertakings. They may be fitted with motor-driven winch gear for use in drawing cable into underground conduits; an electrically-operated pump may be fitted for clearing water from manholes, while a telescopic tower ladder can be provided for trimming arc lamps and for overhead work generally. Where a motor winch is provided, the addition of a simple derrick enables the vehicle to be employed in the erection of street lamps and trolley posts. Where the generating station is not provided with rail or water facilities for the direct delivery of coal, so that the latter has to be carted from the railway dépôt or from a wharf, an electric waggon of suitable capacity should soon pay for itself. The same vehicle could be used for carting away ash and clinker. In demonstration work the electric vehicle promises to be a useful aid. By the aid of a flexible cable carried through the front window of the house, from the vehicle standing outside in the roadway, the canvasser will be able to demonstrate the various domestic uses of electricity.

The Collection of House Refuse.

The collection of house refuse is more trying for steam or petrol vehicles on account of the many stops and starts than to the electric vehicle, which possesses a degree of reliability in such work, together with an economy in operation, which are impossible of attainment by any other type, and, when standing, no waste of power is going on.

Another argument in favour of adopting the "electric" when the change is made from horse haulage is the possibility of utilising the horse-vehicle drivers as the drivers of the new vehicles. In some cases the best economy might be obtainable by a combination of horse-drawn vehicles for the

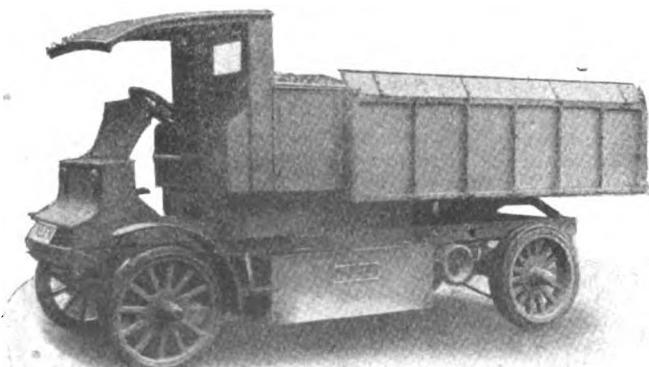


FIG. 4.—AN ELECTRIC TIPPING WAGGON FOR THE COLLECTION OF HOUSE REFUSE.

districts in propinquity to the destructor, with the use of electric vans for the districts further away. An alternative method is the employment for local house-to-house collection of a special type of small electric vehicle, with tipping-box body as illustrated in Fig. 5.

The Urban District Council of Barnes, after a trial of electric

vehicles for refuse collection, has placed an order for four vans. The Surveyor, Mr. G. Bruce Tomes, reports that one electric van would do the same work per week as sixteen horses and carts. The cost of the type of electric van decided upon, with battery and electrically driven tipping gear, is £945. The capacity of the van is 4½ cubic yards, which compares with the 2½ yards of the present cart. As a result of tests, Mr. Tomes found that the cost of operation came out at 19s. 4d. per van per day. The comparable figure for a horse and cart is 11s. per day. Mr. Tomes reported that the replacing of the existing



FIG. 5.—SPECIAL SMALL REFUSE VAN.

horses and carts by four electric vans would, notwithstanding a capital expenditure of £4,000 on the vans and charging plant, result in a saving of at least £400 per annum. A similar trial made by the Surveyor of the Heston and Isleworth Urban District Council resulted in an order for an Edison electric dust van. Experiments were made with electric, steam, and petrol vehicles. It was found that any one of the three waggons could do the same work as previously done by four horses. The purchase costs of the three types of vehicles were: electric, £840; steam, £617; and petrol, £815; the estimated annual costs of working, including capital charges, being given as £333, £338, and £404 respectively. In December last trials were made of the use of electric vehicles for the collection of house refuse in Birmingham, and as a result the Corporation have placed an order for two "Orwell" vans. Dover is another place where electric vehicles are about to be used for the collection of house refuse, the Corporation having decided to order six Edison vans. Each will take the place of three carts and sixteen horses. Electric vehicles have also been used to a considerable extent for refuse collection on the Continent.

Ambulance Work.

By reason of its smooth and silent running, the uniform and jerkless acceleration, the electric is an ideal vehicle for ambulance work in our towns and cities. It has for some time been employed for this purpose by the City of London Corporation, by the Port of London Authority, and the Metropolitan Asylums Board. In addition to advantages of economy, the promptitude with which calls may be answered is as valuable an attribute as in the case of Fire Brigade Service. The simplicity of operation also enable several ordinary attendants to be trained to drive.

In regard to the City Police Ambulances, Captain Sir J. W. Nott-Bower (Commissioner of Police) reports that the cost of working is about 5·1d. per car mile, including expenses such as tyres, necessary repairs to cars, charging of batteries, &c., but excluding wages and rent. Electric ambulances are also in use in the United States. The New York Hospital, for example, has seven such vehicles.

Fire Brigade Work.

Electric battery vehicles have been in use to a considerable extent for fire brigade work. Notable examples of their use are to be found in London and Liverpool; while, up to the outbreak of war, they were known to be employed in several Continental cities, one having no less than 24 in use. Several towns and cities in the United States also employ electrically-propelled fire engines and escapes.

The London Fire Brigade possesses a total of fifteen electrically-propelled vehicles, the oldest having been put into commission in 1911, and Lieutenant-Commander Sladen, R.N. (Chief Officer) recently said :—"Among the advantages of electric vehicles for fire brigade work, we find that they require repairing less frequently, and that the rapidity of turn-out is abso-

lately unequalled by any other form of traction; it is not uncommon at an electric-motor fire station under ordinary service conditions for a turn-out to be effected in 7 or 8 seconds,

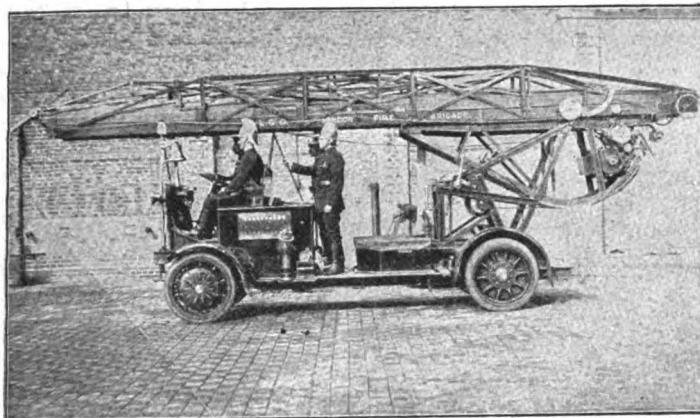


FIG. 6.—ELECTRIC TURNTABLE LADDER, L.C.C. FIRE BRIGADE.

whereas with other forms of motors a good turn-out is perhaps 15 seconds. . . . The maximum speed is at once obtained, whereas with other forms of traction, namely, steam and petrol, a little time has to elapse before things become quite normal."

The Liverpool Brigade has had four electric vehicles, which have given every satisfaction, and cost 2½d. per mile to run.

Reports from American fire departments bear witness to the reliability of electrically-driven engines, even under conditions of heavy snow.

In regard to cost of operation, Lieutenant-Commander Sladen has stated that, in the London Brigade, the electrically-propelled appliances cost, on the average, about 1s. per mile to maintain, not including drivers' wages, capital charges or depreciation, whereas the similar figure for the brigade's petrol vehicles is 1s. 3d. The cost of maintenance of an electric fire-escape and of a petrol fire-escape are about the same, namely, about £150 a year, allowing for interest and depreciation. The annual cost of repairs for an electric escape van that runs about 800 miles per annum is £40, that is allowing for renewals of batteries and so forth. Further information shows that the cost of repairs to accumulators for twelve months worked out at an average price of £22 per vehicle, including a complete renewal of one battery and extensive replacements to three others. The vehicles of the London Brigade can run up to 27 miles per hour on the level, while up a gradient of 1 in 19 the speed is 15 miles per hour. No difficulty has been experienced in converting horse-drawn steam fire-engines and other apparatus, the application of the front wheel drive to which the electric motor so readily lends itself making the problem quite an easy one.

Upkeep and Cleansing of Streets and Roadways.

The electric vehicle is in extensive use on the Continent and in the United States in connection with street cleaning and brushing machines and for watering. One important Continental city having about thirty in use, and the saving stated to result from employing "electrics" in place of horse-drawn vans for this purpose is about £80 per electric van per year. The electric vehicle is also employed for carrying materials used in the making and repair of roadways, and a 3-ton wagon with tipping body has just been put into service for this purpose by the Corporation of Ipswich. It has been suggested that an electrically-driven road roller would be an improvement upon the steam roller. As weight is an essential requirement, a battery of as large a capacity as necessary could be fitted.

The Tramways Department.

There are now three municipal tramway undertakings making use of the electric battery 'bus as an adjunct to their tramway services, i.e., Southend-on-Sea, South Shields, and York.

The South Shields Corporation 'buses have accommodation for 22 passengers, the speed being 12 miles per hour on the level and about 6 miles per hour on gradients of between 1 in 8 and 1 in 10. The energy consumption per mile is under the best conditions about 1·3 units, while the figure runs up to about 2 units per mile when the roads are deep in mud. On a fine day each 'bus will run, if necessary, 50 miles on one charge. A charging station is placed at one terminus, enabling each 'bus to be given a boosting charge several times a day, which enables a fast service to be obtained during the evening without the necessity of charging during the station "peak-load" hours. The 'bus which the Southend Corporation Tramways Department has had in use since June 26th, 1914, is similar to those employed at West Hartlepool. At Southend other 'buses of the petrol and petrol-electric type have also been in use. Mr. Birkett, the Engineer and Manager of the combined electric supply and tramways undertakings, dealing with the running of all three

types, says: "The electric 'bus is the most reliable and free from breakdowns. This is no doubt owing to the simplicity of the mechanism." He gives the actual average cost per 'bus mile (including capital charges) for each type as follows:—Petrol, 8·56d.; petrol-electric, 8·31d.; electric, 7·52d. The consumption of energy on the hilly route is at the rate of 1·55 units per mile, while on a route which is more or less level the figure comes down to 1·1. The 'bus receives a short boost while waiting at one terminus, the boosting current being about 300 amperes. The average speed, including stops, is about nine miles per hour. Battery 'buses are on order for the West Bromwich Corporation and for a company at Loughborough.

The Ilford Council Tramways Departments employ an electric tower wagon, which has now been in service for over twelve months. Although it weighs some three tons, the energy consumption is only a little over a unit per mile. With the exception of the cost of a little distilled water for the battery, no expenditure has been necessary for maintenance during the time the vehicle has been in commission, and there is stated to be no sign of wear upon the tyres. Similar vehicles are in use by, or on order for, the Tramways Departments at Derby and Belfast.

For courtesy in providing the illustrations in the Paper which we have reproduced our thanks are due to Edison Accumulators,

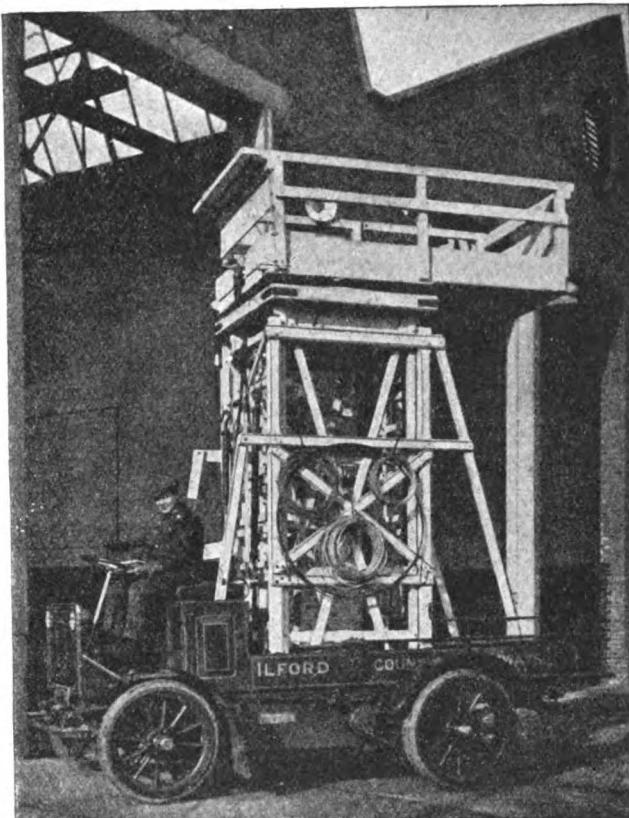


FIG. 7.—ILFORD TRAMWAYS' ELECTRIC TOWER WAGON.

Ltd., the General Motors Co. of America, the *Electrical Times*, and the *Tramway and Railway World*.

Discussion.

In some additional remarks on his paper (which was not read in full at the meeting), Mr. Ayton pointed out that the present was a very opportune time for putting forward the claims of the electric vehicle, the adoption of which would free the demand on commercial users of petrol vehicles, which were so insistently needed by the military authorities. He also emphasised the fact that the electric vehicle did not require the services of professional chauffeurs, a class which could command high wages, and whose services were urgently needed for military purposes.

Mr. W. W. LACKIE (Chief Electrical Engineer, Glasgow) said that the whole electrical industry in this country was indebted to Mr. Ayton for the manner in which he had taken up the question. There was one use to which the Glasgow Corporation had put their electric vehicle which had not been mentioned, and that was for pressure-testing of plant in a sub-station before the supply was available. The Corporation had a motor generator which could be put inside a one-ton van, and this was taken to a sub-station. The motor was connected

to the battery of the vehicle, and this drove an alternator giving alternating high-tension current at 13,000 volts for testing the 6,600-volt plant. A similar arrangement might be used for the testing of mains. He thought that for practically every purpose except touring, the electric vehicle was superior to vehicles propelled by other means. For ordinary carting purposes, the Glasgow Corporation a few years ago were charged 7s. 6d. per day for a horse and cart, but to-day the cost was 11s. 6d. At 11s. 6d. per day it was costing them £160 per annum for a horse and cart, and with a one-ton van they were easily doing what two horses and carts did for £240 per annum, as against £320, for horse haulage. The Corporation now had had three years' results with a one-ton van, and the results had been so satisfactory that three other vans were ordered. The original one-ton van was equipped with the smallest size of Edison battery, and it was found that with one charge it could do 36 to 40 miles. When they came to order further vans, he took the opportunity of putting in an A6 battery into the one-ton van and putting the A4 battery into a new half-ton van. The Corporation found that 35 miles a day did not meet their average requirements for a one-ton van, and with the A6 battery they could get 60 miles with one charge. The other two vehicles they had ordered were a one-and-a-half-ton lorry and a three-ton lorry. With electricity at 1d. per unit, the probable revenue from electric vehicles might be taken as £20 per annum for a half-ton van to £40 per annum for a three-ton van. The high first cost of the electric vehicle would no doubt be rectified, as it must be if we are to get ahead with its use. The Vehicles Committee had very properly standardised charging plugs and one or two other important details, but he thought that something should be done in the way of standardising the weights and sizes of trucks of different carrying capacities.

Mr. C. H. WORDINGHAM pointed out that there were certain questions which the advocates of electric vehicles would have to answer. Numerous attempts had been made to run trams by means of batteries. The tramcar presented the nearest approach to ideal conditions, but was it possible to point to any instance in which battery-driven trams had been a success? Why was it, he asked, that the present advocates of electric vehicles looked forward with such success to electric vehicles running on ordinary roads, when trams using batteries and running on tramlines had failed? Another point was the necessity for really convincing demonstrations of the merits of these cars in comparison with the sort of car they desired to displace. In conclusion, he referred to the standard plug. The Electric Vehicle Committee had been working in conjunction with the Engineering Standards Committee. The standard specification had not yet been issued, although everything was completed last January, as difficulties had arisen in preparing the gauges. However, these were now supplied, and the specification would be issued very shortly.

Mr. R. A. CHATTOCK (Chief Electrical Engineer, Birmingham) said that the electric vehicle was a vehicle for commercial use in carrying goods and heavy haulage, but he did not suggest it was of use for long distances at present. Mr. Wordingham had criticised the possibilities of the electric vehicle from experience obtained with tramways run by batteries. A tramcar was a very heavy vehicle, and it was hardly fair to assume that, because a tramcar had not run satisfactorily by batteries, but was run satisfactorily from a trolley wire, therefore an electric battery was not the proper thing for an ordinary road vehicle. In America there were upwards of 70,000 battery vehicles running, some heavy and some light. He was glad that reference had been made to the Standards Committee, and was glad to have the opportunity of thanking them for the great assistance they had been to the Electric Vehicle Committee.

Mr. J. W. BEAUCHAMP (Chief Electrical Engineer, West Ham) said that there were four users at present of electric vehicles, with two three-ton, three one-ton, and five half-ton vehicles, in his district. Six of these were repeat orders based on the experience of the first one in each case. The most direct method of pushing the electric vehicle was for the Supply Department to use one. His own experience of a one-ton Edison, in use by the Mains Department, was as follows. In use 87 weeks, an average mileage per day of 17½ had been covered in average running time per day. The consumption of electrical energy was 0·6 unit per mile at 1d. per unit. The revenue from mixed commercial electric vehicles appeared likely to be between £20 and £30 per vehicle per annum. He thought it was very desirable for the moment that the efforts of central station men should first be concentrated on the big users of heavy vehicles.

Mr. G. BRUCE TOMES (Borough Surveyor, Barnes) expressed his satisfaction with the working of the electric vehicles used in his Sanitary Department. They were a great advance on anything he had yet used for the collection of house refuse. Considerable saving had been caused by the speed of the vehicles. With horse vehicles, the travelling took about 6½ hours per day, and the collection 2½ hours per day, but with electric vehicles they were able to collect during 6½ hours a day, whilst the travelling only occupied 2½ hours per day. They had also great advantages in quietness.

Mr. H. S. ELLIS (Tramway Manager, Southampton), referring to the Edison omnibuses which had been put into service by

the South Shields Corporation, said that these were used with success as feeders to the tramway system. They were charged at night time at the car shed, where a motor generator set had been installed, and the current was charged at 1d. per unit provided it was taken between 11 p.m. and 6 a.m. At the end of the route there was a small charging station which was utilised for giving a short boosting charge. The result was that the bus was able to remain in service the whole day long, and travelling from 70 to 80 miles per day. For general purposes, he thought that high capital cost and low speed were against electric vehicles, but hoped that both these disadvantages would be got over. The advantage of the electric vehicle was that it was cheap to run, very easy to handle, and the maintenance costs as low as they could possibly be made.

Mr. J. W. HAME (Chief Electrical Engineer and Tramway Manager, York) said the Corporation had four electric omnibuses fitted with Edison accumulators, the first of which was put into service during February. The buses had run up to date 13,600 miles, and the current consumption was 1·1 unit per mile. If the Corporation had purchased petrol buses, the fuel bill for an equivalent week on the same service, which at present amounted to 1,260 miles a week, would be about £509 a year, against £365 for electricity at 1d. per unit. The buses themselves were popular, and there had been extremely little trouble, and, so far as electrical equipment was concerned, no trouble whatever.

Mr. C. E. COOPER (Wimbledon) said that in municipal work there was a unique opening for the electrically-propelled vehicle, especially now that horses and horse labour was so dear, but complained that, so far, there was a lack of properly designed vehicles to suit the municipal authorities in this country.

Alderman LLOYD (Bristol) was also keenly interested in this matter, and was quite satisfied that the future of traction for municipal work was the electric vehicle.

Mr. H. WEBBER (Chief Electrical Engineer, Keighley) detailed some experiences with petrol motor-buses, which had cost 1s. 4d. per mile, and of railless trolley vehicles, the cost of running of which he had worked out at 7d. per mile.

Mr. J. K. BRYDGES (Chief Electrical Engineer, Eastbourne) gave some particulars of the running of petrol motor-buses in Eastbourne, which ran from 90 to 100 miles per day, and cost 1d. a mile. He thought that a double-decked bus was essential which should be capable of running at least 15 miles per hour. At Eastbourne they had to carry all the coal from the railway station to the works. The Department had had a steam wagon doing the work. He had gone into the question of an electric coal wagon about 18 months ago, but the price was excessive for one thing, and the amount it could carry was limited. The steam wagon he had now cost £550, and carried 4½ tons. It was a very big proposition to have to pay £1,100, as he would have had to do, for an electric vehicle for the same work. In Eastbourne there was a good deal of heavy traffic, such as furniture removal vans and brewers' drays, and it would be a good thing for the town and for the electrical undertaking if electric vehicles be employed.

Alderman MEYER (York) supplemented Mr. Hame's remarks on the York omnibuses, and said that, with regard to speed, both trams and electric buses were being run, and both were timed to do the same amount of running per hour.

Mr. J. CHRISTIE (Chief Electrical Engineer, Brighton) had been able to persuade his committee to spend £200 to purchase piecemeal a vehicle which was depicted in the paper. That had been in use for eight or nine months, and it had been most valuable to him in running round the town in connection with his work. He ran about 20 miles a day on it. There had been a fleet of 16 electric omnibuses working in Brighton for six years, and the Electricity Department sold 800,000 units per annum for charging the Tudor batteries on these buses. At Brighton they had had an electric vehicle on trial for a week for dust collection. It was put on every road in the town, and upon some severe grades, and although it was not quite suitable for getting into the destructor, and did not work at a maximum efficiency for that reason, it had proved capable of negotiating the heaviest grades. As to charging, station engineers must assist the people who were likely to use vehicles by making preparations for charging them. He had an old boiler-house, now dismantled, at the main sub-station, which was fitted with a pit, and was capable of accommodating about twelve vehicles.

Mr. A. E. SHAW (Borough Electrical Engineer, Ilford) had gone very carefully into the matter of coal carrying, and had persuaded his Council to give an order for a four-ton electric waggon. Previous to the electric truck, the coal was carted by horses at a cost of 1s. 6d. per ton, but the price with the electric waggon was 10d. per ton. He had also an electric tower waggon which had been in use for 18 months at Ilford, had given every satisfaction, and was considerably less costly than the previous horse vehicle.

Mr. W. H. WATSON (Edison Accumulators) said that a good many remarks had been made against the speed of the electric vehicle, but this matter had not been given proper consideration. The reason why an electric vehicle was so much cheaper than other vehicles in running costs was because they did not endeavour to exceed a suitable speed. First cost did not govern

everything. The ultimate results were things to be looked to. Estimates which all makers of electric vehicles submitted were based on very careful lines. On account of the varying conditions in different towns, they were applied to give a running cost which they knew would be worked to. The users of Edison vehicles would admit that the estimates submitted for these had never been exceeded, and in many cases at least 10 per cent. saving had been shown. Notwithstanding the criticisms regarding price and speed, it was interesting to know that the railway companies were beginning to move in the purchase of electric vehicles. Another movement in the right direction was among brewers, and he had recently received orders from three or four leading breweries. He had been very closely into the matter of refuse disposal, and his company had now brought out the small type of vehicle illustrated in the paper. The capacity was approximately 2 yards, but there was another type which took 4½ yards, and the over-all cost of running it, including capital, interest, and maintenance, not including labour, was £85 per annum, assuming that the vehicle lasted 10 years, and that the mileage covered did not exceed 20 per day. He was rather inclined to think that our present method of handling house refuse was wrong, and had thought out a scheme, the idea of which was to have platform vehicles moving about and doing the actual collection. On these platforms were placed two tanks, the total capacity of which was 4½ cubic yards. Another heavier vehicle, with a very large body, was fitted with a crane, and was used to empty the contents of these tanks into the larger body. The tanks were replaced on the platform trucks, and so the work went on during the day. Having received four or five loads of this description, the big trolley went to the destructor, and thus the system of each collecting van going to the tip and wasting a lot of time was avoided.

Mr. W. WYLD (Chief Electrical Engineer, Hampstead) described arrangements by which the Hampstead Works Committee ran an electric van which they hired from the Electricity Department. A trial showed that the vehicle could do at a cost of 19s. 6d., exclusive of capital charges, what had been costing 35s. The cost of the vehicle was approximately £1,000, and he had practically come to an agreement with the Works Committee for the hire of the van and a man to drive it on the basis of a certain number of days per annum for four years, and the price charged would provide for the purchase of the machine in four years, so that the Electricity Department would have a vehicle which it could use to a certain extent during the year, whilst the hire by the other departments would repay the cost and leave the Department with the vehicle at the end of the hiring period. Meantime, the vehicle would be invaluable as an advertisement for the electric lighting department.

Mr. MEADE (Wolseley Motors, Ltd.) said that the two fields of usefulness of petrol and electric vehicles did not coincide. The petrol vehicle was the one for mileage and carrying loads for long distances. It was not one for short journeys and constant stops. Speed was everything with the petrol vehicle; speed was everything against the electric vehicle. At speeds over 12 miles an hour it would be found that depreciation and maintenance charges would be rapidly increased, because the vehicle was being used for something for which it was never intended. There were people in England to-day who with great advantage used a mixed fleet of petrol and electric vehicles. He was in agreement with municipal engineers on the question of price. It was very much too high, and would have to be reduced considerably.

Mr. AYTON replied to some of the points raised in the discussion, emphasising that the electric vehicle was a moderate speed machine for short haulage work. Although prices would come down as the demand increased, there was plenty of room for business at present figures.

A parade and demonstration of electric vehicles was held on the Embankment after the meeting, and excited much interest. We described the vehicles that were present in our last issue.

MEETING OF THE "POINT-FIVES" ASSOCIATION

THIS Association met at Tricity House, Oxford Street, at 7 p.m. as arranged. In addition to the "point-fives" themselves, there were a few other members of the I.M.E.A. and a sprinkling of visitors, the total attendance being about thirty. An excellent dinner was served, after which the Chairman for the evening, Mr. S. E. Fedden (Sheffield), opened the informal debate with a short address.

Mr. FEDDEN said that, as it was almost impossible to keep away from "the only subject that matters," a mutual interchange of experiences during the present crisis might be interesting. In Sheffield, as in other places, it was anticipated early in August that there would be a slump in business, there were rumours of reductions in staff and of half-pay to such as remained, 30 of his technical and clerical staff and about 60 other employés left to join the Forces, coal deliveries tailed

off, prices of commodities began to leap upwards alarmingly, and everything pointed to a good year being spoiled. The reaction which set in very soon, on the other hand, put a strain on the electrical undertaking nigh unto breaking-point. For the six months ended March 25th last, the units sold were more than double those of the corresponding period of the previous year, viz., 29,303,892, compared with 14,644,168. In addition to this, an additional 10,000 kw. applied for is almost ready for connection, and negotiations are in progress involving an extra 10 to 15 million units per annum. Last year's sales were 45 million units, and Mr. Fedden estimates that this year's will be at least 65 millions. The principal difficulties which have beset him have been station extensions, delivery of plant, coal, and both manual and clerical labour. Last week he had had to agree to a 7s. increase per ton for extending a contract previously at 11s. 6d. per ton.

On bringing this part of his address to a conclusion, Mr. Fedden said:—"I must, perhaps, apologise for such a digression from the usual and orthodox type of address, but in such a grave national emergency how can I bring myself to contemplate the best and most efficient way of grilling chops, or to investigate the precise temperature suitable to the correct consistency of rice pudding? There are other sterner and nobler duties to perform, and when the history of this War comes to be written, it will be found that the nation's electricity undertakings have had no small share in the ultimate triumph to which we are all looking forward with confidence, and with a determination to do all that we possibly can to bring about such a result in the shortest possible time."

Referring briefly to questions relating to electric cooking and heating, Mr. Fedden first mentioned his experience was that no hot-plates yet supplied were really hot enough for frying or omelette-making; moreover, that they took too long to get thoroughly hot, and much heat was wasted if, as happened with "hired help," the current was only turned off when the cooking was finished. [Several speakers subsequently mentioned that these difficulties were non-existent in the Belling "red-hot hot-plate."] For room heating there was want of an apparatus for fixing in a fireplace to look like a fireplace, and he suggested that 3-kw. stoves were now becoming almost too heavy for carrying from room to room. Coffee-pots for six or eight cups might have two elements, so that the slower heating could be employed when fewer cups were needed. Other criticisms he made of apparatus, to promote discussion, were that trouble was still experienced with the flex. of electric irons, and that although the electric oven was excellent for pastry and for meat, &c., it did not make good bread—at any rate, not in the quantities required by families in the north of England.

Mr. BLACKMAN (Sunderland) said that all cooking had been done electrically in his home for the last 18 months, and his large electric ovens were suitable for bread. But for this purpose they must be large. He had the flexibles of irons inspected every six weeks to avoid trouble. Cab-tyre sheathed flex. was, he found, not flexible enough; it was only a seven-strand wire. He had had good results with "terroid" flex. As to coal contracts, he had been particularly fortunate, as he had made a contract for six months last January at 1s. a ton less than last year.

Mr. ROLES (Bradford) said that on renewing his coal contract, he had been offered coal at prices 60 per cent. above the price paid last June. There was, however, a great scarcity, and he had had to pay a high price. A contract which he had just made for six months would mean an increase of expense at the rate of £12,000 a year, but it was not all loss, owing to the coal clause in the power contracts.

Mr. COOKE (Luton) agreed as to the average electric oven being too small, and the necessity of having a hot plate which would get hot quickly and cold quickly. Referring to the question of increased outputs, he mentioned that he had just placed an order for 3,000 kw. of plant for next winter.

Mr. BRITTON (Chester) said that he had been doing cooking for five years with the same oven (a Bertram Thomas) and had had only one breakdown. As this was simply an oven, he had first used self-contained utensils as well, but he found them unsatisfactory after repair, so he now used hot plates and had obtained the best result with a 3-heat hot plate.

Mr. PICKVANCE (Wrexham) said he had tested three or four different kinds of cookers in his own house during the last five or six years, and had had no failures with breakfast, and only one with dinner. Answering a question as to whether he had tried them long enough, he said that they subsequently went into consumers' houses and gave satisfaction there. He complimented Mr. Belling on the trouble he always took to meet his customers' wishes and suggestions, and the excellence of his red-hot hot-plate. Referring to coal contracts, he said that he had fixed up a contract from April 1st at the same price as last year.

Mr. G. W. DAVIS (Chairman, Ilford Electricity Committee) made a statement with regard to the Ilford case brought by the gas company. He said that it would have come before the same judge as the Long Eaton case, and it was felt that it would have to be fought to the House of Lords. With their limited revenue of under £25,000 a year, it was not worth the expense, especially as they could probably get the necessary

Parliamentary powers for all time at less cost than that of fighting the action.

Mr. HOADLEY (Maidstone) said that he could speak only as a visitor, as the charge for cooking units at Maidstone was 0'6d. and not 0'5d. In his own house, the entire cooking had been done by electricity for four years. He took weekly readings of the consumption, and during the last few weeks, when his wife had been doing the cooking instead of the cook, the units had been reduced from 50 to 30. He considered the red-hot boiling ring a great advance.

Councillor CROWTHER (Sheffield) said that he had obtained good results from electric cooking in his house, and he thought that electrical engineers should have better faith in the efficiency of their own apparatus.

Mr. BOWDEN (Poplar) said that he hoped that increase of prices would not be the general rule. The electricity works had a great opportunity at present, when the gas companies were increasing their prices, and they should continue to supply at the same price per unit as hitherto, so long as they could make both ends meet. At Poplar they had actually reduced the price for domestic lighting from 4d. to 3d., and in the case of the Point-Five tariff had reduced the fixed charge. Referring to the coal question, he said that he had bought coal in November at a better contract price than earlier in the year, but could not get it delivered. He can now buy the same coal—of the same quality and from the same pit—at 21s. instead of 10s. 6d. Within the last month he had hired forty trucks, and was now getting a quantity of coal by this means at the original contract price. Referring to the discussion with regard to hot plates, he said that in his opinion the red-hot plate was the only one which had come to stay, although he had had some trouble with it.

[Mr. Blackman suggested that this was due to its being used with alternating current, and Mr. Bowden said this was so. Apparently, from various speakers' remarks, troubles with hot plates were far more frequent with alternating current, due to connecting screws working loose—a thing that the makers might presumably easily prevent by the use of lock nuts or spring washers.]

Mr. WOODHOUSE (Yorkshire Electric Power Co.) said that there was a definite coal famine, and future prices would be greater than in the past. High coal prices were, however, really to the benefit of the electrical supply industry, as they would affect the competitive methods of lighting, heating, and power to a greater extent than the cost of electric supply.

Mr. S. T. ALLEN (Wolverhampton) said that he now gets coke dust at 3s. 4d. and mixes it with small coal, using the mixture on underfeed stokers. He proposes to put in special stokers and burn it by itself. He had been successful with electric cooking in his own house, and endorsed what had been said with regard to the Bellring red-hot hot-plate. He had put it in the kitchen for a fortnight and then taken it away for a fortnight, and put it back again, and he had found that the units always went down when it was in use. His records for faults in flex. showed that these amounted to only 2½ per cent. per annum.

Mr. RAPHAEL said that the flex. with untinned copper wires covered with a layer of cotton and then pure rubber and cotton instead of vulcanised rubber, and the whole braided circular, gave a much longer life, and he now specified this for all purposes.

Other speakers were Mr. Hame (York), Councillor Sauvage (Wrexham), Mr. Shaw (Ilford), Councillor Barge (Poplar), Mr. Williams (Jackson Electric Stove Co.), Mr. W. R. Cooper, Mr. A. S. Barnard (Chloride Co.), and Mr. Barham (Watford). Several of the Councillor speakers severely criticised the debate which had taken place at the I.M.E.A. meeting in the morning, regretting that it had chiefly been devoted to discussing the method of arriving at the fixed charge.

The meeting terminated at about 11 p.m.

The annual general meeting was held on Friday morning.

THE COUNCIL'S REPORT

(Slightly abridged.)

THE report first explained the circumstances which had affected the arrangements made for the present meeting. When war was declared, Major H. Richardson, the President, wrote that he had been called up for war service, and would be unable to attend any meetings until after the termination of his military duties. The Council appointed Mr. A. C. Cramb (the Senior Vice-President) as Acting President during Major Richardson's absence. The President at the same time expressed the view that the Convention should be postponed, but that the ordinary work of the Association should proceed as usual. Under the Articles of Association, however, it is necessary to have an annual meeting, and the Council therefore resolved that the usual Convention should not be held in 1915, but that the annual meeting should be held in London, instead of in Dundee as previously arranged. It was resolved to arrange a business meeting to occupy two days, that no social functions should be held, and that the attendance be restricted to members and

official delegates of local authorities, and to members of the Electric Vehicle and Development Committees.

Office of President, 1915-16.—Since it has become evident that there is little likelihood of Major Richardson being able to give his services to the Association throughout the ensuing year if he were re-elected to office, his views have been ascertained, and in conformity with these the Council suggest that his name should be placed on the list of Past Presidents, and they record their desire that at the first opportunity he should be nominated for another term of office as President.

Model General Conditions of Contract.—It will be remembered that upon considering the model general conditions of contract placed before the annual general meeting in June, 1913, and further considered at a subsequent extraordinary general meeting held in the following month, it was resolved that the Association of Municipal Corporations should be consulted and that until the report of a Joint Committee, composed of members of that Association and of the I.M.E.A., had been laid before the general body of members, the Council were not to communicate with the B.E.A.M.A., or any other body, on the question. The Association of Municipal Corporations was immediately approached, but that body did not move very quickly, and it was not until the day before the annual meeting of 1914 that the Council received from the Association of Municipal Corporations a proof of the document as they had amended it. Even then it had not been submitted to the governing council of that body, but only to the Legal Council, and was the outcome of a joint meeting between representatives of the Association of Municipal Corporations and of the I.M.E.A. Council held six months previously. In the meantime the Council of the B.E.A.M.A., which had not at that time been consulted by the A.M.C. regarding the proposed amendments, decided to adopt the model general conditions as issued by the Institution of Electrical Engineers for a period of one year in respect of municipal contracts in order to see how they worked. The B.E.A.M.A. asked for the views of the Council upon this proposal, and inquired if they would fall into line with it. In the circumstances no reply could be given, and the matter is left as heretofore for each Corporation to deal with the manufacturers direct. The A.M.C. has since been in negotiation with the B.E.A.M.A., but arrangements have not reached a report stage.

I.M.E.A. Bill.—The Council has decided that no further action be taken in connection with the suggestion for a Joint Private Bill, and that the Association revert to the pressing forward of a Bill promoted in the manner originally arranged. The Acting President, Mr. A. C. Cramb, had an interview with Mr. Rawlings, the President of the Electrical Contractors' Association, as a result of which the Council decided that no further concessions be made beyond those contained in the Bill as last printed. After careful consideration of the results of the I.M.E.A.'s Parliamentary propaganda in support of the Bill Messrs. A. C. Cramb, Bailie Smith, A. H. Seabrook, S. K. Fedden, and H. Faraday Proctor, were appointed as a Sub-Committee to meet the B.E.A.M.A. with a view of discussing this question with them. Particular attention is drawn to the fact that the Corporation of Glasgow has arranged terms upon which it will operate its Publicity and Sales Departments. The Electrical Contractors' Association in Scotland have agreed to these terms which are less advantageous to themselves than those to which the Electrical Contractors' Association take exception in the Bill. [See ELECTRICAL ENGINEERING, March 25, p. 128.]

Delegate's Expenses.—The Association is represented by the Acting President, Mr. A. C. Cramb, on the Committee formed by the Royal Sanitary Institute to consider the question of obtaining powers for local authorities to pay delegates' expenses to annual Conferences.

Engineering Standards Committee.—The Association is represented by Mr. A. H. Seabrook and Mr. A. C. Cramb on the Sectional Electrical Committee, and is also represented on the various electrical sub-committees. The Council has voted twenty guineas as a donation to the Engineering Standards Committee, and make a special appeal to the Committees who control municipal electrical supply undertakings to give their generous support to the Standards Committee by making an annual subscription towards the fund.

Long Eaton and Ilford Cases.—Mr. Faraday Proctor has presented a valuable report on the subject to the Council. Having carefully examined the tariffs of over one hundred of the municipal undertakings, he was of opinion that there were only a few which might be subjected to attack on the grounds of the objections alleged in the Long Eaton and Ilford cases. Some of these cases were at the time receiving consideration with a view to amendment, and in other cases the Engineers were prepared to recommend amendments if such were thought desirable.

Lamp Specifications.—The Tungsten Lamp Association invited the Council to send representatives to form a Joint Committee to discuss the outlines of the specification proposed to be put forward by the Tungsten Lamp Association. As the Council were already represented on the Sectional Committee of the Engineering Standards Committee dealing with a similar subject, they did not see that any useful purpose would be served by meeting the Tungsten Lamp Association, bearing in mind the views which the I.M.E.A. representatives held on the matter.

L.G.B. Loans.—The Council has had under consideration the action of the Local Government Board in refusing loans for extensions, &c., owing to the war. After most careful deliberation and consideration of the subject from all points of view, including that of the desirability of bringing the war to a successful conclusion at the earliest possible date, the Council felt that they could not recommend action being taken on general lines. It was thought that the case of each undertaking should be considered upon its merits.

War Office and Enlistment.—With the object of ensuring that members of the staff of electricity undertakings should not be accepted for enlistment without special permission, the War Office had been approached, pointing out the desirability of preventing the depletion of the staff below the minimum necessary for the carrying on of the works of Electricity Departments. The War Office agreed that those who were of necessity engaged on such works were doing equal service to the country as those who had enlisted. The War Office has given consideration to the question of issuing a badge or certificate of exemption, but could not see its way to fall in with the proposal.

Joint Motor Committee.—The B.E.A.M.A. invited the Council to appoint four members to form a Joint Motor Committee. Messrs. A. C. Cramb, A. H. Seabrook, S. E. Fedden, and J. W. Beauchamp were appointed to represent the I.M.E.A. The suggestion of the B.E.A.M.A. was that there should be a standard specification which should be adopted by the I.M.E.A., and that an arrangement should be made as to preferential discount to undertakings in their districts where such undertakings have the power to sell motors. The Joint Committee eventually recommended that the I.M.E.A. and B.E.A.M.A. should adopt a standard specification for direct current motors, preferably that to be issued by the Engineering Standards Committee, and until this was issued, the B.E.A.M.A. motor specification. The Council have suggested several modifications to the specification, and the matter is still under consideration.

Board of Industry.—Messrs. H. Faraday Proctor, S. E. Fedden, A. H. Seabrook, A. C. Cramb, and Bailie Smith attended on behalf of your Council a joint meeting of representatives of the B.E.A.M.A. and the British Engineers' Association to consider the question of the protection of British interests. Proposals were made for the formation of a Government Department to be entitled the Board of Industry, and it was decided to invite the I.M.E.A. to appoint a representative on the Joint Committee, one of the main objects being to secure the principle that public money should be expended only on British manufactures. Mr. A. C. Cramb (Acting President) was appointed to represent the Association upon this Committee.

Municipal Loans.—The Council has supported the recommendations made by the Institution of Electrical Engineers in regard to the periods allowed for the repayment of loans, as follows:—

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| (a) Cables substantially constructed and laid | ... 30 years |
| (b) Conduits substantially constructed | ... 60 years |
| (c) Accumulators and batteries in cases where the sanctioning authority is satisfied that adequate provision has been made for the proper maintenance of the batteries | ... 15 years |
| (d) Reinforced concrete | ... 30 years |

Institution of Electrical Engineers Benevolent Fund.—In response to the recent appeal issued on behalf of this fund the Council decided to subscribe a sum of £10 10s. from the funds of the Association.

Report of the Development Committee.

A report of the Development Committee is appended to the Council's report. The activities of this Committee have been reported in our columns from time to time (*ELECTRICAL ENGINEERING*, Jan. 7th, p. 3, March 11th, p. 104, and April 1st, p. 139), but the following additional information is of further interest. Various sub-committees, who report occasionally to the Development Committee on the progress of their work, have naturally been working under some difficulties in view of the present abnormal conditions. The Publicity Sub-Committee have, after due deliberation, insisted upon the absolute necessity of providing regular funds and the establishment of at least a small paid staff whose whole time could be devoted to the work. They have also opened communication with the Publicity Committee of the London electric supply companies, with a view, if possible, to combining the efforts of all classes of electric supply undertakings in regard to publicity, to avoid wasteful overlapping, and bring about at the earliest moment an organised campaign for the development of public electricity service. At the present time the Sub-Committee are not in a position to report progress in this direction. Communications have also been received and considered from the Society for Electrical Development. New York, the Manager of which (Mr. Wakeman) was good enough to offer assistance and, so far as possible, means of co-operation between publicity undertakings on both sides of the water, and it is hoped that in circumstances more favourable to this class of work than those at present obtaining, this idea may be developed.

The Electrical Installations Sub-Committee will proceed so

far as possible:—(a) To examine, tabulate, and describe the various methods of wiring in use, with advantages and disadvantages, with a view to bringing about any possible reductions in the cost of installation work compatible with safety. (b) To obtain the assistance and opinions of practical men in touch with this class of work, and to promote discussion on the subject. (c) To promote practical criticisms of accessories in common use, in connection with installation work, with a view to collating information which would be valuable to manufacturers and users. (d) To take an early opportunity of considering alternatives to the present design of plug contact for heating, cooking, and other purposes, particularly in regard to the possibilities of superseding the ordinary pin or concentric patterns by some more satisfactory form of plug contact.

The Secretary of the Domestic Appliances Sub-Committee has reported preliminary work done and plans for the immediate future; it is proposed to carry out various investigations with regard to hot and boiling plates, and to invite the advice and criticisms of manufacturers in connection with that subject.

The Development Committee has considered a letter from Mr. C. H. Wordingham to the Secretary of the I.E.E., dealing with the question of establishing a central testing institution or proving house. The Committee associated itself with the views expressed by Mr. Wordingham therein, but urged that the National Physical Laboratory and its existing organisation should be employed whenever possible.

Report of the Electrical Vehicle Committee.

A report from this Committee is also appended to the Council's report, and summarises the work which has been done by the Committee during the past year, most of which has been reported in *ELECTRICAL ENGINEERING* in the ordinary course. The subjects mentioned are the establishment of a standard design of charging plug; the desirability of a uniform charging tariff of 1d. per unit; the fixing of a standard charging voltage between 85 and 120, and a standard number of cells (44) for vehicles with lead batteries; and the standardisation of a sign for charging stations.

At the instance of the Society of Motor Manufacturers and Traders, the Engineering Standards Committee decided to standardise certain rims for solid rubber tyres, and the Committee decided to support the Association in this important matter by recommending that these rims, of the following sizes, should be used for all commercial electric vehicles:—670 mm., 720 mm., 741 mm., 771 mm., 850 mm., and 881 mm. The Committee have also issued recommendations with regard to the instruments to be used on electric vehicles.

Arrangements have been made with the Commercial Motor Users' Association. The Committee will have a voice in all future arrangements in regard to parades of motor vehicles, in so far as such arrangements apply to electric vehicles. The Association has also very kindly offered to allocate to the use of this Committee a section in the next edition of its "Night Shelter Handbook for Commercial Vehicles," in which the Committee can set forth information as to charging stations about the country, tariffs, &c., and the Association has also offered to include a map upon which these charging stations may be indicated.

While this report mentions the special matters dealt with by the Committee, it does not detail the many other directions in which the Committee has been active in stimulating interest in the electric vehicle, and making efforts to promote its adoption. In closing the report, the I.M.E.A. representatives on the Committee express their thanks to the co-opted members for the extremely valuable work which they have so willingly performed during the year under review, without which the progress made would have been impossible.

Discussion.

Engineering Standards Committee.—Mr. R. A. Chattock said that a considerable number of members of the Association were representatives on this Committee, and were in personal touch with the work that was being done. The Standard Specifications issued by the Committee were of great assistance to municipal electric supply engineers, and saved an enormous amount of work in the preparation of their own specifications. For this reason the Council felt that it was justified in voting a sum of twenty guineas to the funds of the Standards Committee.

Local Government Board Loans.—Mr. H. Faraday Proctor (Hon. Secretary), referring to the above, said he had a letter from Sir John Snell, who, together with Mr. Sparks, President-elect of the Institution of Electrical Engineers, Sir John Wolfe Barry, President of the Institution of Civil Engineers, and Sir Alexander Kennedy, on behalf of the Institution of Mechanical Engineers, was forming a deputation to wait upon the Treasury with reference to municipal loans. Nothing definite had been done up to the present, but the three Institutions in question were showing sympathy towards municipalities, and he only wished to assure the members of the Association that their interests were being very well looked after wherever these interests coincided with the interests for the furtherance of the war. All the members of the Association had been circulated with regard to the matter, and inquiries were made as

to what municipalities wanted loans and the purposes of the loans. He himself went very carefully through all these, and the important cases were referred to Sir John Snell, who had taken, or was taking, this matter up with the Government Departments.

Alderman Barge (Poplar) moved, and Mr. E. S. Rayner (Doncaster) seconded, the adoption of the report, which was carried unanimously.

Balance Sheet.—THE CHAIRMAN explained that, unfortunately, the Hon. Treasurer, Mr. J. S. Edgcome was not sufficiently well to be present. The balance sheet was then adopted unanimously.

The Report of the Development Committee.—Mr. S. E. Fedden, as Chairman of this Committee, introduced the report for the past year. He said that it had been decided to cut the work up into districts for different parts of the country and to co-opt persons who were not members of the Association, but who would be useful to these Sub-Committees. It had been suggested that the present time was not really opportune to carry on such publicity work, but after very carefully considering the matter, it had been decided that, whilst the Committee was not going on with its work in an energetic manner, it would keep it alive, and, if possible, get the first organisation finished, and try to do some advertising if it could be done without any heavy expense.

The Electric Vehicle Committee.—Mr. R. A. Chattock (Chairman of this Committee) called attention to the large amount of work done during the past twelve months, especially in connection with the standardising of apparatus to be used with the vehicles. He referred also to the success of the Parade on the previous day, and the quarterly issues of the Committee's Journal, and reminded the audience that contributions to the Committee's fund were acceptable.

Mr. S. J. Watson, who seconded the adoption of the Report, emphasised the splendid work which had been accomplished on behalf of the Committee by Mr. Ayton, the Hon. Secretary.

Election of Officers and Council.

The following is the result of the ballot for officers and members of Council for the year 1915-16.

President: A. C. Cramb (Croydon).

Vice-Presidents: F. M. Long (Norwich), A. H. Seabrook (St. Marylebone).

Past-Presidents: G. Wilkinson (Harrogate), R. A. Chattock (Birmingham), Major H. Richardson (Dundee).

Members of Council: J. W. Beauchamp (West Ham), A. S. Blackman (Sunderland), S. E. Fedden (Sheffield), T. Roles (Bradford), W. A. Vignoles (Grimsby), W. Wyld (Hampstead), S. E. Britton* (Chester), W. W. Lackie* (Glasgow), S. L. Pearce* (Manchester), Councillor Crowther (Sheffield), Alderman Ellaway (Birmingham), Alderman J. P. Smith (Barrow-in-Furness), Baillie W. B. Smith (Glasgow), Councillor H. R. Barge* (Poplar), Alderman Sir J. Beecham* (St. Helens).

The names marked with an asterisk are newly elected.

Place of Meeting for 1916.—It was decided that the selection of this should be left in the hands of President and Council.

Insurance Against Aircraft Damage.—Mr. H. Faraday Proctor read a letter from Mr. J. E. Edgcome, the Hon. Treasurer, asking the Association to pass a resolution urging the Government to pledge itself to bear the cost of damage to property from hostile aircraft. The Council, said Mr. Proctor, was in sympathy with Mr. Edgcome's views. The following resolution was then carried unanimously: "That this Meeting is of opinion that the Government should hold themselves financially responsible for all damage to real and personal property situated in the British Isles, directly attributable to the present war."

Coal Supplies.—Baillie Smith, who had been representing the I.E.E.A. on the National Conference, said that after the very large meeting of the gas and electrical industries which had been held at the Institution of Electrical Engineers, a Committee had been formed to approach the Government. This was done about three weeks ago, and a dozen members had an interview with the Government Committee controlling the export of coal. It was found that that Committee had the whole thing at its fingers ends, and they could trust that Committee implicitly to keep a very tight grip on the question of letting coal go out of the country to neutral countries that were rather questionable. To our Allies that Committee would see that the coal was allowed to go out. About a week ago the Committee formed by the Conference was called to the Grand Committee Room at the House of Commons, and met about 200 members of Parliament, before whom they put the case, and a very good impression was made as to the necessity for some action. On Tuesday of that week a similar meeting was held with those members of Parliament, the representatives of the gas and electrical industries being led by Sir Corbet Woodall. The result was that a committee of twelve had been formed to go into the matter, and was to meet on the previous day, and it was hoped that within a week it would report to the Government and make some recommendations as to action. The six speakers representing gas and electricity industries were unanimous on two leading points. The first was the necessity of getting miners to work at least full time. In a report pre-

sented to the Government by a Committee formed a little while ago to inquire into the conditions in the coal-mining industry, it was admitted that there was avoidable absenteeism from 4 to 12 per cent. The second point was very well spoken to on the Tuesday afternoon by Sir Arthur Markham, Bart., of Mansfield, a colliery owner himself. He told members of Parliament that a fictitious and unreasonable price was being charged by colliery owners for coal, and he recommended the Government to form some organisation that would control and fix the price of coal in each district, and at each colliery, based on the price of coal a year ago, plus the necessary increase in price, but not to allow colliery owners to charge any speculative or fictitious price over and above that. He hoped the Government would adopt that view. Certainly just now it appeared to the Committee that the Government had got a move, and that they were going to do what they had been asked to do.

The Electrical Emergency Service.—Mr. H. Faraday Proctor (Honorary Secretary) said that he had brought the matter before the Council that morning. ELECTRICAL ENGINEERING, as no doubt most people were aware, had been energetic in taking up the question of the supply of switchboard attendants. There was a considerable shortage, both in London stations and the provinces as well as, of course, of other technical assistants. Mr. Raphael (Editor of ELECTRICAL ENGINEERING) had felt for some considerable time past that men who were engaged on other work than electricity works might take occasional shifts in electricity works as switchboard attendants, and he had registered the names of many such men, and had placed several of them in stations and sub-stations in London. Mr. Raphael thought that with the support of this Association the matter might be taken up and the movement extended into the provinces. In many provincial centres no doubt that might be arranged. In centres situated in engineering districts there were many technical men with a certain amount of electrical knowledge, but in some other districts it would be very difficult to find men who would be competent to take even the somewhat light duties of switchboard attendants. The Council did not propose that this matter should be thoroughly discussed that morning, because they felt that there were so many details in the arrangements that it would take up too much time. They therefore suggested that if it met with the approval of the members, it should be with the Council to make arrangements with Mr. Raphael, and if any of the members had any difficulty in getting temporary assistants or assistants during the war, they should apply either to the Council, or direct to Mr. Raphael, upon the matter.

Electric Cranes.—At a recent meeting of the Junior Institution of Engineers, Mr. C. H. Woodfield read a Paper on cranes and brought out many of the advantages of electric cranes over those worked by steam and by hydraulic power. The former lead easily in respect of first cost, durability, economy in working and upkeep, and in ease of control. And where many cranes were employed the fact of the power supply being centralized gave them a great advantage over isolated steam cranes. For warehouses, &c., the choice was between electric and hydraulic working, and a serious disadvantage of the hydraulic crane was the fact that it cost as much to lift the minimum as the maximum load. In comparing with steam cranes, he mentioned the superior overload capacity of the electric crane, its ease of control, and the advantage that power was always available without keeping a local boiler under steam. Again, the rate of insurance was less with electric power.

Soft Soda Glass suitable for X-ray Bulbs.—The Glass Research Committee of the Institute of Chemistry find that a glass such as that made from formula No. 10, recently published by them and recommended for X-ray bulbs (see ELECTRICAL ENGINEERING, April 13th, p. 164), does not give a green phosphorescent glow if it is made from approximately pure materials. The slight glow given is blue. In view of the fact that a green phosphorescence appears to be preferred by users of X-ray tubes, it seemed desirable to determine the conditions for obtaining this effect. It has been traced to the presence of manganese, and such a glass as No. 10 will give this green glow if manganese dioxide is added to the batch mixture in the quantities frequently used to correct the colour due to iron.

The Electric Vehicle Committee.—At a meeting on June 11th Mr. A. R. Fearnley (General Manager of the Sheffield Corporation Tramways) was co-opted as the representative of the Municipal Tramways Association. It was decided to send in a request that evidence be heard by the Special Committee of the Local Government Board on Motor Traffic with regard to the effect of the use of electric vehicles. The Secretary was instructed to write to the representative electrical institutions in the Colonies suggesting the advisability of adopting the Committee's standards in regard to electric vehicles. The next meeting will be held in September.

Electric-light Switching Competition.—The following is additional to the list of successful overseas competitors published in our issue of 10th instant:—*Preliminary Certificate*—Sapper H. C. Page, R.E., 40th Coy., R.E., Wellington Barracks, Hong Kong.

COAL SUPPLIES

THE Members of the House of Commons who are interesting themselves in this matter, presided over by Lord Claud Hamilton, held a further meeting on the 15th inst. to discuss the question of the difficulties arising owing to the scarcity in supplies and the high price of coal and freights. The discussion was confined to the Members of Parliament, the deputation representing gas and electricity interests not being called upon for any further opinion.

The previous work of the deputation was referred to on p. 252 of our last issue. At the conclusion of the meeting it was proposed, and carried unanimously, that a Committee of twelve should be elected to consider the whole question and formulate recommendations to be laid before an adjourned meeting of the Members of Parliament.

The Committee is constituted as follows, viz.:

Colliery Proprietors.—Sir Arthur B. Markham, Bart., M.P., Sir Alexander Henderson, Bart., M.P., the Hon. H. D. McLaren, M.P.

Shipowners.—Sir Walter Runciman, M.P., Mr. R. D. Holt, M.P., Mr. R. P. Houston, M.P.

Workmen.—The Rt. Hon. Charles Fenwick, M.P., Mr T. Richards, M.P., Mr. B. Kenyon, M.P.

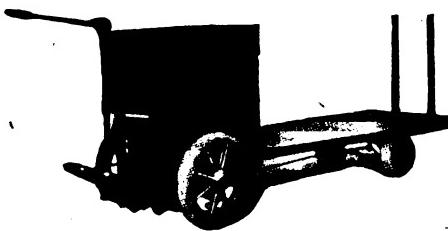
Consumers of Coal.—Mr. W. Joynson Hicks, M.P., Sir Daniel Ford Goddard, M.P., Sir Corbet Woodall.

In connection with the above, Bailie Smith, of Glasgow, made an interesting speech at the annual meeting of the I.M.E.A., reported elsewhere in this issue.

The *Times* of yesterday stated that at the final conference between Members of Parliament, coal consumers, shipowners, coal masters and miners, the following resolutions were passed:—“(1) That during the continuance of the war the maximum price of coal, for home consumption and export to our Allies, at the pit-head be fixed on the basis of the prices charged at the pit-head for substantial quantities of coal sold during the twelve months preceding the war, with an addition of 4s. 3d. per ton, or such other sum as may be prescribed, to cover the increased costs owing to the existence of the war. (2) That the rate of freight for coasting steamers employed in the coal trade be fixed on the basis of the rate charged for freight during the twelve months preceding the war, with an addition of such sum as will reasonably cover the increased cost owing to the existence of the war, and that the Government be urged to assign a further number of the interned steamers for the use of the coal trade. (3) That the Government be asked to regulate the price charged by the merchant to the consumer.” It is added that whilst the first two recommendations were passed practically unanimously, there was a considerable minority against the third. The resolutions are to be presented to the Board of Trade.

ELECTRICAL PLATFORM TRUCKS

A NUMBER of models of self-propelled trucks equipped with Edison batteries are being put on the market in this country by the Railway Track Supply Co. (80 Gracechurch Street, E.C.). These very handy little vehicles have already been taken into use by several British railways, and their advantages render them suitable for a variety of purposes in works, warehouses, and other industrial establishments where goods have to be moved about. A considerable



ELECTRICAL PLATFORM BAGGAGE TRUCK
AS USED BY G.W.R.

saving of labour as well as increase in speed is attained by their adoption—matters of great importance especially at the present time. Various patterns are made, some with flat platforms and some with drop frames, some with the mechanism above the platform and some below. The general principles of the propulsion and control are, however, the same in all of them. The motors are wound for 25 volts, except on some of the more powerful vehicles, which can

act as tractors and draw several trucks, in which case a 50-volt equipment is used.

The driver stands on a little platform in front, arranged with springs so that it is only horizontal when he is standing on it. It is made in two portions interlocked with the control and brake gear, so that as long as the driver stands on the left-hand half the main circuit is closed, but is opened automatically when he steps aft. In like manner the right-hand half keeps the brake off. Thus when the driver is not on his platform the truck is locked by the brake and cannot be started by moving the controller. As an additional safeguard the controller is arranged to take up its neutral position if released. Steering is effected by all four wheels, so that a very narrow turning circle is possible. In some cases control apparatus is provided at both ends of the truck. An enclosed motor is used, driving through a geared universally-jointed countershaft, which carries pinion gearing into an internal rack on the driving wheels. The controller is of the drum type, giving three speeds by certain groupings of the field windings. The battery is of 21 A6 cells of 225 ampere-hours capacity, and a speed of five to six miles per hour is attainable with full load of 4,000 lb. The weight of the truck complete is 1,880 lb. The details of the design are thoroughly well thought out, and the large extent to which they are used in America testifies to their utility.

ELECTRIC TRACTION NOTES

The strike upon the L.C.C. tramway system had the effect of reducing the revenue during the time it last by some £77,000.

The revenue of the Glasgow Corporation Tramways for the year to May 31st shows a decrease of about £8,000 compared with the previous twelve months.

The Hove Corporation has decided to postpone further progress with its trolley-omnibus scheme until three years after the war. This matter has been the subject of much controversy between Hove and Brighton, and at one time the Board of Trade was asked to arbitrate.

The result of the past year's working of the G.B. surface-contact system at Lincoln has been the slight increase in running costs per car-mile of from 5'91d. to 6'37d. The cost of repairs to the G.B. equipment, whilst slightly less than in the previous twelve months, is still considerably in excess of the average guarantee of £90 given by the Company, and the actual average cost of repairs to the equipment has now increased to £110 per annum. Mr. Stanley Clegg, the Tramway Manager, however, points out that evidently the £90 guarantee was on the basis that the G.B. system would be applied in many other towns, and that in consequence the cost of repair parts would be considerably less than was now actually the case when they all had to be made specially as required.

The Bill relating to the pooling of funds, &c., of the railways associated with the Underground Electric Railways Co. of London has undergone considerable change since we last referred to the matter on p. 219 of our issue for May 20th. As the result of a meeting of the promoters, opponents, and the authorities of Parliament, the promoters have agreed to strike out all powers dealing with the interchange, &c., of traffic and the establishment of a Joint Committee, thus limiting the measure to the pooling of the receipts of the companies. It has also been agreed to insert a clause preventing any powers being conferred upon the London General Omnibus Co. The L.C.C., however, is not yet satisfied, and suggests further amendments to the effect that any agreements under the Bill should be subject to the approval of the Board of Trade, the Council to have an opportunity of submitting its views; that any pooling arrangement shall be shown in the accounts, and that the Bill shall only remain in force for three years.

The report of the British Electric Traction Co. for the year to March 31st, 1915, shows a net profit of £135,057 after deducting debenture stock interest. The payment of full dividend on the 6 per cent. cumulative preference stock and 3½ per cent. on the 7 per cent. non-cumulative preference stock is recommended. The balance of £71,399 is carried forward, no sum being carried to reserve for depreciation in view of the fact that the directors now propose to proceed with the capital reorganisation scheme which was passed before the shareholders last July, but which was postponed in consequence of the war.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

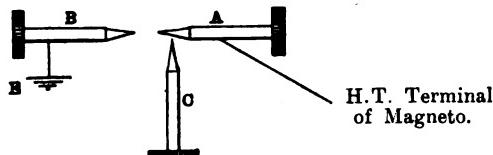
QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,448.

It is the custom in testing magnetos to connect the high-tension terminal through a spark gap to earth, the gap being such as that shown on the accompanying diagram, the points



being lettered *A* and *B*. It is found, however, that when a further point, *C*, insulated from both of the others, and from earth, is introduced, as shown, the magneto sparks much more readily. What is the explanation of this?—"RADIIUM."

(Replies must be received not later than first post, Thursday, July 1st.)

ANSWERS TO No. 1,448.

A manufacturer sent a shunt motor and starter, both in perfect order and carefully inspected and tested, to a distant job. He received a telegram from his customer stating that the motor ran enormously above its rated speed. What is the most probable reason that the manufacturer would suggest for this?

The first award (10s.) is given to "E. B. P." for the following reply:—

The most probable reason for the racing of the motor is wrong connections, as shown in Fig. 2. Here the field

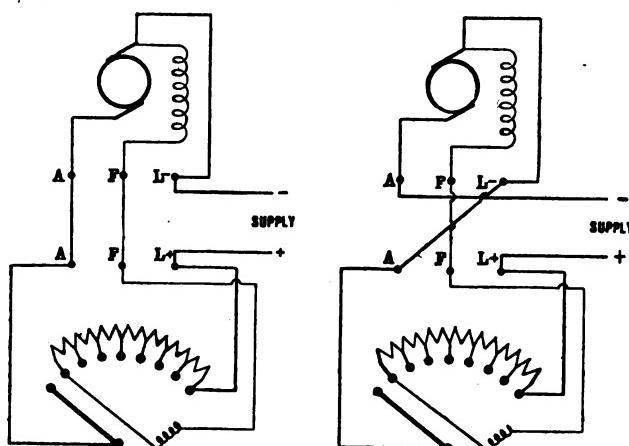


FIG. 1.

FIG. 2.

winding is connected as a shunt across the starting resistance. The effect of this is as follows. On

first switching on, practically all the voltage-drop occurs across the starting resistance; since the field is connected as a shunt across this, the P.D. between its terminals will be high and a strong field will be the result, enabling the motor to start easily. As the motor runs up its B.E.M.F. increases, and the P.D. across the starter and the field winding decreases, weakening the field. This action goes on as more and more of the starting resistance is cut out, till at full-speed position the field winding would be short-circuited and the field strength zero. The speed of the motor will therefore increase very rapidly. The correct diagram of connections is given in Fig. 1 for comparison. The terminals are lettered in the way they probably would be on the actual motor and starter, and it will be seen that the terminals affected are the "A" and "L" terminals on the motor.

The second award (5s.) is made to "E. H.," who writes as follows:—

The speed of a given motor depends upon two factors, namely, the counter E.M.F. and the exciting current. In a shunt motor on no-load the counter E.M.F. is practically the same as the terminal voltage. Now it might be that the voltage had been incorrectly specified, or that the motor was connected between the outer instead of between one outer and the mid-wire of a three-wire system. A customer, however, would probably check these points before communicating with the manufacturer. By far the most likely reason for the very high speed of the motor is that the starter has been wired to the motor terminals in the manner indicated in the figure. Any other arrangements of the connections—except the correct one—would result either in a short-circuit across the mains, or in a short-circuit of the shunt

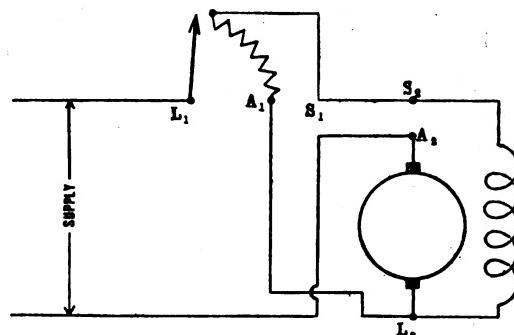


FIG. 3.

winding, so that the motor would not even start. In Fig. 3 the shunt winding is actually connected across the starting resistance. Now, when such a motor is started, by far the greater portion of the supply voltage is absorbed in the starting resistance. The current in the shunt winding is, therefore, only slightly less than its normal value, with the result that the motor starts up without any difficulty. As the speed increases and the starting resistance is cut out, the voltage across and the current in the shunt winding decrease, until, when the starter is "full on," the shunt is short-circuited. Hence the enormous speed of the motor. The connections are easily corrected by changing over the leads at *A*, and *L*, i.e., by joining *A*, to *A*, and *L*, to the line. The probable reply of the manufacturer would therefore be:—Check voltage; if correct, cross over two main leads at motor terminals.

ANSWER TO CORRESPONDENT

C. G.—(1) Small fan motors for running on A.C. circuits are frequently constructed on the same lines as D.C. motors, but usually with the field system laminated to reduce iron losses, and thus form single-phase series commutator motors. The ordinary resistance starter can quite well be used in such cases. (2) The current supplied to the electrodes of an ozone plant is at sufficiently high pressure (5,000 to 10,000 volts) to cause what is known as a silent discharge between them, and this pressure is obtained from a step-up transformer supplied with A.C. A full description of one of the ozone plants on the Central London Railway was given in ELECTRICAL ENGINEERING, Vol. VIII., page 261, May 16th, 1912. (3) We have no information as to the size of the batteries employed in the case you mention. Batteries are sometimes rated in watt-hours, but the ampere-hour rating is more usual. The lamps are most likely of the metal filament type.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 17th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

12,867/14. Heating Elements. C. O. BASTIAN. Resistances for heating purposes composed of relatively fine wire wound in a single layer on a quartz or other rod. The contiguous convolutions are sufficiently insulated from one another by a coating of oxide on the wire. (Three figures.)

13,159/14. Series Generators. COMPAGNIE DE L'INDUSTRIE ELECTRIQUE. An improved form of high-tension continuous-current series machine controlled by shifting the brushes, in which the field magnet is constructed like the stator of an induction motor, but with the slots only partly filled with copper for the purpose of reducing to a predetermined minimum value the induction in the armature teeth, and in consequence reducing the eddy current and hysteresis losses in the armature. (One figure.)

13,247/14, 13,248/14, and 6,476/15. Production and Amplification of Continuous Oscillations. MARCONI'S WIRELESS TELEGRAPH Co. and H. J. ROUND. The first of these describes an improved form of vacuum "oscillation valve" tube, which can be used either for magnifying or for producing continuous oscillations for wireless telephony or telegraphy. The tube contains a heated cathode and an anode, and has a constricted portion, to which an external metallic coating is applied, taking the place of a grid or screen within the tube. An electromagnet adjacent to the constricted portion also acts on the discharge. (One figure.) The second specification describes a scheme for using such a tube for the production of continuous oscillations, the special feature of which is the insertion of a condenser in the circuit of the coating or screen, shunted by a high resistance and potentiometer arrangement to increase the stability of the valve. (Two figures.) The last specifies the use of a cathode in the form of a tube of platinum coated with lime heated by an internal carbon filament. (One figure.)

13,362/14. Automatic Telephones. C. A. W. HULTMAN. In an automatic telephone exchange a selecting arrangement in which the subscribers' wires are arranged in bundles of any parallelogrammic cross-section, but having a plurality of the subscribers' wires along both sides of the parallelogram, each subscriber's wire being arranged in a single group, and the line selectors being arranged so as to be movable along the sides of the parallelogram to co-operate with the subscriber's wire, the line selectors being connected with number switches, which in turn can be connected with the calling subscriber, only one line selector being, however, used to perform the connection between two subscribers. (Eight figures.)

17,686/14. Joint-box Compound. W. H. WALKER. A compound for cable joint-boxes for exposed situations, which remains plastic indefinitely and protects machined iron surfaces, composed of prepared chalk 60 to 80 per cent., vaseline 10 to 20 per cent., oil risini 1 to 5 per cent., and oxide of iron paint 1 to 5 per cent.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, &c.: FOX [Combined motor and generator] 7,746/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Motor control] 13,231/14; AYRES [Starting A.C. motors] 13,709/14.

Heating and Cooking: HOWARD [Liquid heater] 10,930/14;

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Erit.—One 2,000-kw. high-pressure turbo-alternator with condensing plant, switchgear, &c., and one water-tube boiler with all auxiliaries. Borough Electrical Engineer. July 5th.

HENRY WILSON & Co. and FAIRBAIRN [Electric heaters] 17,345/14; HOWARD [Water heater] 2,387/14.

Ignition: KETTERING and CHRYST [Ignition and engine-starting system] 4,762/14; VARLEY [Ignition apparatus] 5,040/14; WILLIAMS [Sparkling plugs] 14,156/14.

Incandescent Lamps: ELECTRIC UTILITY Co. and LONG [Repairing incandescent lamps] 8,683/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Manufacture of tungsten] 13,076/14 and [Shaping filaments] 14,229/14.

Storage Batteries: COUNELL and HOHNE [Battery plates] 20,671/14.

Switchgear, Fuses and Fittings: OWNBEY [Rotary switches] 3,701/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Liquid rheostats] 13,238/14; HOLT [Switches] 19,598/14; MCPHERSON and SHADWELL MFG. Co. [Lighting cinema theatres] 506/15.

Telephony and Telegraphy: SIEMENS BROS. & Co. [Circuits for semi-automatic telephones] 5,841/14; RELAY AUTOMATIC TELEPHONE Co., BRYANT and WARD [Automatic telephones] 13,173/14; CONNER and ROBINSON [Telephone systems] 13,410/14; MARKS (Delany Foreign Co.) [Telegraphy] 18,677/14.

Traction: KETTERING and CHRYST [Engine starters] 13,002 and 13,057/14; RENEAULT [Engine starters] 15,464/14.

Miscellaneous: MARSCHALL [Thermopiles] 6,102/14; BARROWS [Electric mining signals] 13,810/14; CADENCE [Electro-magnetic locking devices] 13,715/14; DIXON [Fire alarms] 17,732/14; LEA [Electric couplings] 1,600/15; MIDGELEY and VANDERVELL [Switches for motor-car horns] 3,003/15 and [Dashboard lamps] 4,276/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrometallurgy: PERREUR LLOYD [Electrolytic production of zinc] 4,625 and 4,681/15.

Ignition: POGNON [Sparkling plugs] 6,593/15.

Miscellaneous: LANDIS & GYR A.G. [Short time switch] 6,991/15.

Applications for Suspension

10,457/06, B. HOFFELT; 2,711/10, 20,634/10, 9,941/11. SPECIAL FABRIK FÜR ALUMINIUM SPULEN & LEITUNGEN G.m.b.H. (Berlin) and 27,651/12. J. LOEWENTHAL. Aluminium Conductors. Licences have been granted on the application of G. H. Wilson, trading as the Manchester Armature Repair Co., in relation to these enemy-owned patents. All relate to the manufacture of coils of aluminium wire with the only insulation between turns consisting of a film of oxide or other aluminium salt on the surface. In the last-mentioned, a film of aluminium compounds is electrolytically deposited on a conductor of other metal.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS and TRANSFORMERS: W. GEIPEL and F. M. T. LANGE [Control of printing press motors] 5,213 and 5,214/04; B.T.-H. Co. (G.E. Co., U.S.A.) [motor-generators for searchlights] 4,379/05; B.T.-H. Co. (A.E.G.) [Motor-generators for searchlights] 15,130/08; B.T.-H. Co. and A. A. POLLOCK [Motor-generators for searchlights] 23,070/08.

Heating and Cooking: H. J. DOWSING [Electric light bath cabinets] 5,119/04.

Instruments and Meters: O. SCHULZE [Eddy current meter brakes] 13,136/08.

Telephony and Telegraphy: H. CARBONELLE [Copying telegraph] 5,187/07 and 19,516/09.

Miscellaneous: J. and G. J. SUTTON [Fire alarms] 5,087/07 and 3,204/08.

Halifax.—The Electricity Committee requires a 5,000-kw. turbo-alternator with condenser; two natural-draught cooling towers, and a water-tube boiler with superheater and mechanical stokers. Borough Electrical Engineer. July 1st.

Luton.—Extensions at an estimated cost of £27,000 have been sanctioned by the Council. The plant includes a new turbo-alternator, sub-station and converting plant, and H.T. and L.T. cables for connecting with a new sub-station in which two 500-kw. converters will be placed. (See "Tenders Received" column.)

Manchester.—Additional electric lighting plant, Baguley Sanatorium. City Architect. June 28th.

Miscellaneous

Australia.—The Sydney Corporation requires fuses and fuse-boxes. Preference will be given to British manufacturers. Further particulars at 73 Basinghall Street, E.C.

**TENDERS RECEIVED AND ACCEPTED
AND ORDERS PLACED**

Carlisle.—A contract has been entered into with the Tudor Accumulator Co. for the maintenance of the battery at the power station for ten years at £55 per annum.

Edinburgh.—A recent recommendation by the Electric Lighting Committee to accept a tender by the Stirling Boiler Co. for water-tube boilers for the new power station at Portobello at £32,286 has been confirmed by the Corporation by 18 votes to 14. There was some opposition on the ground that such large capital expenditure should not be incurred at the present time.

London.—The Postmaster-General has placed a contract with the Edison & Swan United Electric Light Co. for a six months' supply of Royal Ediswan tungsten drawn-wire lamps.

Luton.—In connection with the proposed extensions referred to in our "Tenders Invited" column, the Electricity Committee recommends the acceptance of a tender by the Brush Electrical Engineering Co. for a 3,000 to 3,700 kw. Ljungstrom turbine at £11,175.

Salford.—The Electricity Committee recommends the acceptance of a tender by the British Westinghouse Co. for a 5,000-kw. turbo-alternator. In a report by the Committee, it is stated that a similar plant ordered from Messrs. Willans & Robinson last October could not be delivered for many months owing to War Office demands upon that particular firm, hence the transfer of the order.

APPOINTMENTS AND PERSONAL NOTES

Mr. Raymond J. Mitchell has resigned his position as commercial engineer to Edison Accumulators, Ltd., to take up a position as engineer to Mr. E. Sanger Shepherd, (5, 6, and 7) Gray's Inn Passage, Holborn, whose work extends over many scientific fields, including colour photography and telegraphic transmission of photographs.

Mr. Cameron Gibson, Borough Electrical Engineer at Nuneaton, has been released by the Council for military duty.

Mr. S. J. Watson, Borough Electrical Engineer at Bury, has joined the local Munitions Committee.

Mr. R. N. Mayne, Borough Electrical Engineer at Redditch, who recently obtained a commission in the Army, has been released by the War Office at the urgent representation of the Corporation, who desire to keep Mr. Mayne at his post in view of the responsibility attaching to keeping supply going in the district.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £95 to £96 (last week, £96 to £97).

Agency.—A firm in Dartmouth (Nova Scotia) desires to represent British manufacturers of electrical apparatus,

fittings, and accessories. Further particulars at 73 Basinghall Street, E.C.

Bankruptcy.—Mr. Trevor Duesbury, Borough Electrical Engineer at Sutton Coldfield, has been adjudicated bankrupt.

LOCAL NOTES

Belfast: *Reconstruction of Electricity Department.*—Schemes for the reconstruction of the Electricity Department still continue to be drafted, and, judging from a discussion at a recent meeting of the Corporation, neither the Electricity Committee nor the Corporation seem to know whose duty it is to make a move next. The matter has been referred backwards and forwards between the Committee and the Corporation on several occasions, but the latest report on the matter is by Mr. T. W. Bloxam, the City Electrical Engineer. This report is now being printed.

London: *Hammersmith: The Amalgamation Scheme.*—The Council has expressed its approval of the amalgamation scheme referred to on p. 258 of our last issue.

Southampton: *"Northumberland" Clause Refused to Gas Co.*—A Committee of the House of Commons on Tuesday refused an application by the Southampton Gas Co. for the insertion of the "Northumberland" Clause in an Electric Lighting Order which has been granted by the Board of Trade to the Southampton Corporation extending the area of supply to the parish of Bitterne. The Gas Company asked that the Clause, which provides for a revision of prices every three years in the event of a loss being made upon the undertaking, should be applied not only to the extension area, but to the whole Borough of Southampton. Sir John Snell gave very effective evidence on behalf of the Corporation, and stated that in the only case in which a Gas Company had endeavoured to force the application of the Clause, he had been compelled to advise the Gas Company that the position of the borough would be worse if the Clause were enforced, as further losses would be incurred by an increase of prices. Sir John Snell also stated that in the case of Winchester a few years ago he supported the Clause on behalf of the Gas Company, but had since been compelled to change his opinion.

Torquay: *Extensions Stopped by the L.G.B.*—According to the *Western Morning News*, the L.G.B. has given instructions for the work in connection with the extension of the Torquay Corporation electricity generating station to be stopped at once. The scheme was for the expenditure of £16,000 for the supply of new machinery and the alteration of the existing buildings to hold it. Of the amount stated, £12,000 was for machinery, and the orders had been given and much of the plant completed. It is understood that the Corporation will not suffer any loss, as arrangements have been made which will be satisfactory to the contractors and the Corporation alike.

Metal Filament Lamp Patents.—In the Chancery Court on Tuesday, Mr. Justice Joyce commenced the hearing of a case in which an action is brought by Osram Lamp Works, Ltd., against Pope's Electric Lamp Co., Ltd., for alleged infringement of Patent No. 23,899/04 of Just and Hanaman, which describes a method of manufacturing "squirted" tungsten filaments. The case was opened by Mr. A. J. Walter, K.C., for the plaintiffs, and details of the process used by the defendant as revealed to the plaintiff's experts were described by Dr. Passmore in his examination by Mr. Colfax, K.C. The case was continued yesterday, and was still proceeding when we went to press. A fuller report will appear in our next issue.

Obituary.—We regret to announce that Mr. Ralph P. Hulton, who was formerly North Country Representative of Holophane, Limited, has succumbed to wounds received in the operations at the Dardanelles. Immediately upon the outbreak of war, Mr. Hulton enlisted in the Engineer Section of the Royal Naval Division.

The death is announced of Herr Rathenau, Managing Director of the Allgemeine Electricitäts Gesellschaft of Berlin, at the age of seventy-six.

The Ediswan Works.—The Society of Engineers paid a visit to the works of the Edison & Swan United Electric Light Co., Ltd., at Ponder's End, Middlesex, on Thursday of last week, where, in addition to inspecting the various processes of incandescent lamp manufacture, including the blowing of the bulbs in the recently extended glass-houses, they were shown the extensive shops devoted to switches, switchboards, instruments, and other electrical accessories.



ELECTRICAL ENGINEERING

With which is incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, JULY 1, 1915.

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Rates for Small Prepaid and Official Advertisements, see p. vi.
Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 208-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Orcing, Fleet, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LARDEN COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

OUR advertisement pages announce a great extension in the range of British-made half-watt lamps.

AN important metal filament lamp case, in which Osram Lamp Works, Ltd. are suing Pope's Electric Lamp Co., Ltd., for alleged infringement of patent, is now being heard (p. 283).

OUR illustrated description of the electrical installation at the Regent Palace Hotel is concluded (p. 285).

SOME of the features of electrical working in mines in America are discussed in a review of an article by an American engineer (p. 286).

CONSIDERABLE trouble has been experienced in a group of mines in France, where shot-firing is carried out from a station on the surface, by the effects of lightning causing premature explosions (p. 286).

THE patents dealing with electric mining and metallurgy and published during the past month are reviewed (p. 287).

THE advantages and disadvantages of the "non-arcing" metals for use as fuses are discussed in our questions and answers columns (p. 288).

THE orders for the week of the Engineering Institutions Volunteer Training Corps are given on p. 288.

AMONG the subjects of specifications published at the Patent Office last Thursday are incandescent lamp-repairing and filaments, heaters, telephony, and A.C. motors. A Westinghouse railway signalling patent expires this week after a full life of 14 years (p. 289).

A NEW quick-break and quick-made tumbler switch is described (p. 290).

EXTENSIONS are to be carried out at Darlington (£34,950); at last the Manchester Barton power station scheme has been sanctioned; mains and transformers are required at Stalybridge (£4,000) (p. 291).

THE effect of the working agreement between Poplar and Stepney is reflected in the increased efficiency of the Poplar system last year.—A sum of about £20,000 for extensions at Salford is to be taken from the renewals fund.—The Fulham, Hammersmith, and Battersea linking-up scheme has received the sanction of the Fulham and Hammersmith Councils (p. 292).

THE OSRAM v. POPE PATENT ACTION

A S briefly announced in our last issue, a commencement was made on Tuesday of last week in the hearing of an action for infringement which is brought against Pope's Electric Lamp Co., Ltd., by the Osram Lamp Works, Ltd. The case is being heard by Mr. Justice Joyce, and the counsel for the plaintiffs are Mr. A. J. Walter, K.C., Mr. H. H. Colefax, K.C., Mr. J. Hunter Gray, and Mr. E. Lunge; and for the defendants, Mr. T. Terrell, K.C., Mr. T. E. Hughes, K.C., and Mr. E. Russell Clarke.

The patent in question is No. 23,899* of 1904 [Just & Hanaman], which will be remembered to have figured prominently in the case against the "Z" Lamp Co. in 1912 (see ELECTRICAL ENGINEERING, Vol. VIII., p. 218, April 15th, 1912). The following is a brief abstract:

It describes a process of manufacturing filaments of pure tungsten by mixing finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide with an organic binding medium such as collodion, or a solution of cellulose in chloride of zinc or cupreous ammonia oxide. The filaments squirted from the resulting paste are then carbonised (in some cases after denitration), and the carbon is then removed by passing current through the filament and raising it to a high temperature in an atmosphere of steam and hydrogen. The carbon is oxidised to form carbonic oxide, and a filament of pure tungsten is left. The filaments are then rendered uniform by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen, whereby the tungsten deposited equalises the filaments. [The patent was amended in 1909, and was published in full in its amended form in ELECTRICAL ENGINEERING of September 9th of 1909, Vol. V., page 737.]

The plaintiffs allege infringement of this patent, and claim damages and delivery up of the articles made in its infringement. The defendants deny infringement, and allege that the invention described in this patent was not new in view of prior knowledge, and that the statements therein are ambiguous and misleading, and do not give all the particulars required for a successful result.

In opening the case for the plaintiffs, Mr. A. J. Walter, K.C., recapitulated the history and state of the art of incandescent lamp manufacture prior to the patent in question, calling attention to certain patents which would figure in the case. No. 1,535/98 of Welsbach, the validity of which had been upheld by Mr. Justice Warrington in the case against the "Z" Co., referred to the manufacture of osmium filaments containing carbonaceous materials in various ways, and decarbonising by heating in an atmosphere of steam and hydrogen. Among other patents, he referred to that of Abel (20,277/04), wherein Siemens & Halske suggested a process for making wire-drawn filaments of tungsten; but there were difficulties in working the process described, although other metals could then be made into drawn wires. There was also the German specification No. 154,262, granted to Just & Hanaman in 1903, in which tungsten was obtained from its oxychloride. The other patent (abstracted above) of Just & Hanaman covers a process in which the carbon from the binder

was burnt out, as had been done in the case of osmium, in the presence of hydrogen. This patent had also been upheld by Mr. Justice Warrington in the case already mentioned, and he contended that no other metal would work with the form of the process described, nor had anyone suggested trying tungsten in this way before this specification. Others had tried coating carbon and other filaments with tungsten, but had failed. He then read the judgment given in the "Z" case, but emphasised that he was now only dealing with the one patent. He further summarised the two processes used by the defendants. In one of these the filament, squirted from a mixture of powdered tungsten and its oxide with a carbonaceous binder, was dried and then heated in a vertical tube furnace of iridium or porcelain, gradually passing up from the cold to the hot end of the furnace to a temperature of 950° C. in a stream of hydrogen. Here it was first carbonised at the lower temperatures, and subsequently the tungsten oxide was reduced and the steam formed oxidised the carbon and burnt it out, while oxidation of the tungsten was prevented by the protective action of the hydrogen. This substantially amounted to the process described in the specification. The filaments were then heated to about 220° C. in air, which partially re-oxidised them, and again treated in a similar manner in the iridium or porcelain furnace, but this time heated to 1,850° C. to complete the action; in another process used by the defendants the heating was done in a vacuum, instead of in hydrogen.

Dr. F. W. Passmore was then examined by Mr. Colefax on matters of detail relating to the process described in the patent alleged to be infringed, and the state of the art at the time of that patent. In his opinion the facts known regarding osmium would tell nothing about the behaviour of tungsten, as there were various differences in the chemical behaviour of the two metals; there was nothing in the Welsbach patent to show how to make a squirted tungsten filament. He denied that the description of the process was in any way ambiguous or insufficient, and said that there was no need to set forth the proportions of the materials used. He had had no difficulty himself in making filaments in accordance with the description in the Just & Hanaman patent. He then described in detail the processes used by the defendants as demonstrated to him.

This description was concluded when witnesses' examination was continued on the Wednesday, and Dr. Passmore was further examined on the results of analyses of the materials and filaments showing the proportions of carbon, &c., at various stages in the process. Particular attention was drawn to the re-oxidation which occurred on the "second ovening" at 220° C. He then passed on to experiments of his own to determine what was the agent in the defendants' process by which the carbon was removed, heating the substances in question in a vacuum and analysing the gases given off. These experiments showed that the effect was due to the steam formed and the hydrogen present, just as in Just & Hanaman's process; this was shown particularly by the fact that carbon monoxide was produced. Other experiments showed that at temperature below 950° C. tungsten oxides alone were powerless to remove the carbon without water, although a vigorous action of this nature occurred above 1,000° C.

Dr. Passmore was then cross-examined by Mr. Terrell, and said that furnaces of the kind used in the defendants' process were not known at the time of the Just & Hanaman patent, although electrical heating of the filaments was. He did not admit that it was possible to make a tungsten filament by simply substituting tungsten for osmium in the process described in Welsbach's patent of '98, and would have been unable to tell without experiment whether it was possible. Some discussion also took place on a process of producing tungsten filaments by heating carbon filaments in an atmosphere of tungsten oxy-chloride when the carbon is replaced by tungsten. This process is described in an earlier German patent of Just & Hanaman, and Dr. Passmore did not quite agree that was the same process as that originally included in the Just & Hanaman English patent and afterwards disclaimed by amendment.

The cross-examination of Dr. Passmore was continued throughout the whole of Thursday's sitting. He gave it as his opinion that the carbon could not be completely eliminated by this process. Other points in which he disagreed with the defendants' view were that he thought that tungsten carbide was not formed in the defendants' process, nor could their process be considered analogous to the oxychloride process with the oxychloride replaced by oxide. He was submitted to a long cross-examination regarding the knowledge at the time of the patent proceeded on of the reduction of tungsten by hydrogen, and as to the possibilities of the process patented in America by Bottome, which produced a compound carbon and tungsten filament. Although the process depended on reduction by hydrogen and water vapour, a pure tungsten filament could not be obtained by it. Nor did the heating in the Bottome process produce a true sintering of the filament. The American patents 575,002 and 575,668 of Lodyguine were also for compound filaments. After some discussion on the details of the Just & Hanaman patent alleged to be infringed. Dr. Passmore was cross-examined on his experiments and the conditions under which they were performed, but he could not agree with the view put by Mr. Terrell that the quantity of hydrogen given off in the vacuum experiments was too low to support the plaintiffs' theory that the action was due to the effect of water vapour produced

incidentally, and not to direct action. He emphasised again that tungsten oxide did not react direct on carbon below about 1,000° C. Even when a higher temperature was reached, as in the second furnace in the defendants' process, the water action would predominate.

On Friday Dr. Passmore was further cross-examined at length regarding his experiments, but upheld the view throughout that the action was due to water vapour present. Mr. Terrell then detailed a number of experiments by the experts who would be called by the defendants. Dr. Tait's experiments were directed to proving that no free carbon existed in the filaments, as they could be dissolved in mild alkaline oxidising solvents of tungsten carbide, in which carbon was insoluble. Mr. Ballantyne had made confirmatory experiments, but witness did not regard these as conclusive, as there was a possibility that carbon might, in certain circumstances, dissolve in the reagents used. Other experiments were quoted to combat Dr. Passmore's statement that carbon did not react on carbon directly below 1,020° C., but witness again considered that they were not conclusive, as the action might have been due to water present. Counsel also cross-examined witness on further experiments of the defendants' experts to show that tungsten filaments could be made by using all the atmospheres mentioned in the Welsbach osmium patent, and that filaments could not be made satisfactorily with all the materials as stated in the Just & Hanaman specification. Another point taken up was the question of whether the Just & Hanaman specification should not be held to contemplate only heating by electric current, and Mr. Terrell suggested that this was evident from the fact that the filaments were carbonised to improve their conductivity, a view in which Dr. Passmore did not concur.

The case was then adjourned till Tuesday to give Dr. Passmore an opportunity to try further experiments.

Dr. Passmore's cross-examination was concluded on Tuesday regarding the details of various experiments. Mr. Terrell suggesting that if the witness's theory of the action was correct, the decarbonisation should be greater at the top of the filament which was longer in the hot part of the furnace. Some argument ensued on this point, but Dr. Passmore did not agree that this result would necessarily follow.

Mr. Walter then re-examined Dr. Passmore on the details of the defendant processes. Witness thought that it made any difference to the action if the filament were heated electrically, as in the specification, or externally, as by the defendants. It was impossible to make a tungsten filament according to any of the specifications cited as anticipating, and his own experiment to check those of the defendant's efforts on the making of filaments, according to the instructions of Just and Hanaman, were much more successful. Mr. Terrell afterwards put a few questions to Dr. Passmore.

The next witness was Sir James Dewar, who corroborated generally the results and inferences of Dr. Passmore during his examination of Mr. Colefax. The case was still proceeding when we went to press.

Manchester Industrial Reserve.—The Manchester Municipal School of Technology has arranged with the Munitions Committee to open a register of persons willing to devote the whole or part of their time to service in connection with munitions production. For those whose experience in engineering workshops is limited, classes, for which a small fee (five shillings for ten hours' instruction) will be charged, are to be conducted in the workshops of the School in order to provide preliminary training in order to enable suitable persons to be recommended for employment in the manufacture of munitions of war.

International Engineering Congress, San Francisco.—A booklet has been issued by the Committee of Management of the International Engineering Congress to be held at San Francisco, September 16th-25th, containing a general programme of the Congress. We are asked to state that copies can be obtained by mail from Mr. W. A. Cattell, Secretary, International Engineering Congress, 417 Foxcroft Building, San Francisco, Cal., U.S.A.

Scholarships in Heating and Ventilating Engineering.—Two heating scholarships, tenable in the Faculty of Engineering of University College, London, each of the value of £50 a year, together with £11 11s., being the amount of College fees, may be awarded in July by the Institution of Heating and Ventilating Engineering. Candidates must produce evidence that they have already pursued a course of engineering training and are familiar with the work of an engineering laboratory. The research students will be required to devote their whole time to research work in connection with heating and ventilating engineering. Full particulars can be obtained from the Secretary of University College, London, to whom applications must be made not later than Wednesday, July 7th, 1915.

The National Electric Light Association.—This year's Convention of the American National Electric Light Association has been held in connection with the Panama-Pacific Exhibition at San Francisco, under the Presidency of Mr. H. H. Scott. The meetings of the various sections were held on June 8th to 11th, and the programme included a large number of papers on technical, administrative and commercial matters.

THE ELECTRICAL INSTALLATION AT THE REGENT PALACE HOTEL

(Concluded from p. 265.)

THE circuits from the main distribution boards to the various floors are all separately metered, and these boards are fitted with G.E.C. cartridge fuses. All the switchboards, together with the local distribution boards (which are of the carrier-fuse type) and most of the accessories, were supplied by the General Electric Co., who also supplied the 180 miles of cable and the 300,000 ft. of screwed-barrel "Geekoduct" in which the wiring is carried out. All the cable used is of the 2,500-megohm grade. In the building, much accommodation was left for the wiring to save undue "cutting away," and "dummy beams" on the ceilings of the various floors have been put in for the same purpose. The draw-in boxes are watertight, and are to a special design of Messrs. J. Lyons & Co.'s electrical engineers, and the lengths of tube are screwed together with brass unions where running sockets are used in the ordinary way, thus doing away with the long thread liable to rust and short life. The distributing switch and fuse boards were also specially designed by the electrical engineers.

The usual hotel arrangement of two lamps and two 3-way switches is adopted in the bedrooms, and ordinary 10-ampere plugs and switches are put in for the electric fires. Among the fittings in the public rooms we noticed particularly some artistic but not too ornate bowls used in the large "Rotunda" lounge and elsewhere, and some neat lustre fittings in the grill-room. The large dome of the "Rotunda" lounge has a line of 30-watt lamps behind opal bull's-eyes in the risers, giving a novel but pleasing effect; and around the dome is a ring of 180 lamps, not visible from floor-level, designed to throw a considerable volume of light into the glass dome. For reasons which will be apparent to our readers, these are not now in use.

The scheme adopted for the electric bells is simpler than the usual bell-signalling system in large hotels, but should be equally effective. Each floor is complete in itself and divided into eight sections, each with a large indicator. By means of a four-point relay an indicator is also operated in the service room showing which section has been rung up. When the chambermaid goes to that particular section she is shown by the section indicator the number of the room calling. At night the bells and buzzers on the bedroom floors are switched off, and each floor is switched on to a night call indicator in the porter's office on the ground floor and another in the basement hall. All the bell-wire is 300-megohm grade and drawn in heavy-gauged screwed barrel, and no multiple cable is employed at all.

Waygood-Otis lifts are employed. There are five electric passenger lifts, each constructed to carry a load of 15 cwt.s. at a speed of 300 ft. per minute, the height of travel varying from 85 ft. to 122 ft. 3 ins.—this last travelling from the basement to the roof. The cages are fitted with safety apparatus, designed to arrest the descent of the cage in case of failure of the suspension ropes. The motors are coupled to machine-cut worm and wheel winding gear designed for smooth running.

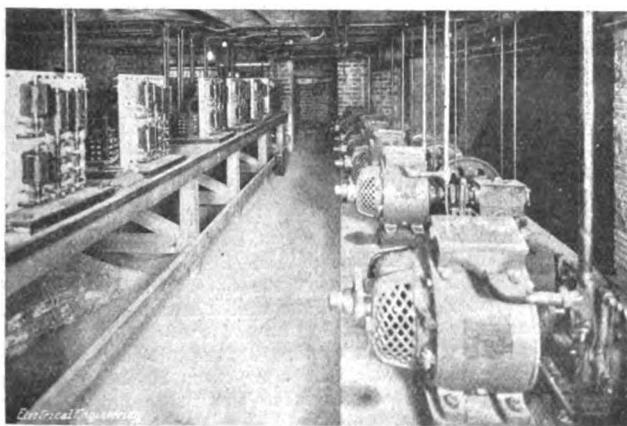


FIG. 6.—LIFT MOTORS AND CONTROL GEAR.

Each lift is controlled by a pilot switch in the cage operated by a removable handle which actuates the main controller. In each cage a flashlight annunciation signal fixture is fitted. When a passenger wishes to call a lift he pushes the button on the enclosure and this illuminates in each cage a miniature lamp representing that particular floor, and also operates a buzzer. The first cage arriving at the floor from which the signal is given will stop and pick up the passenger, and upon leaving the

floor will automatically extinguish the signal lamp in all cages. The signal is entirely automatic in its operation, and gives the operator no opportunity to extinguish it until he has reached or passed the floor from which the signal is given. The indicator also shows the direction in which the passenger wishes to travel as well as the floor on which he is standing. One call-push on each floor is arranged for two lifts, and one for the other three lifts. On the ground floor in connection with each lift is provided a mechanical indicator with arrows working on a semi-circular dial, which will show the position of each lift in the shaft. Up and down signal lights are fitted on intermediate floors, which indicate the direction in which the lift is travelling.

Fig. 6 is from a photograph of the lift motors and control gear in the basement.

There is also an electric luggage lift carrying a load of 15 cwt.s. at a speed of 300 ft. per minute, and two electric goods lifts of the same duty which travel from the basement to the ninth floor.

Fig. 7 shows the line of buffing machines for cleaning boots,

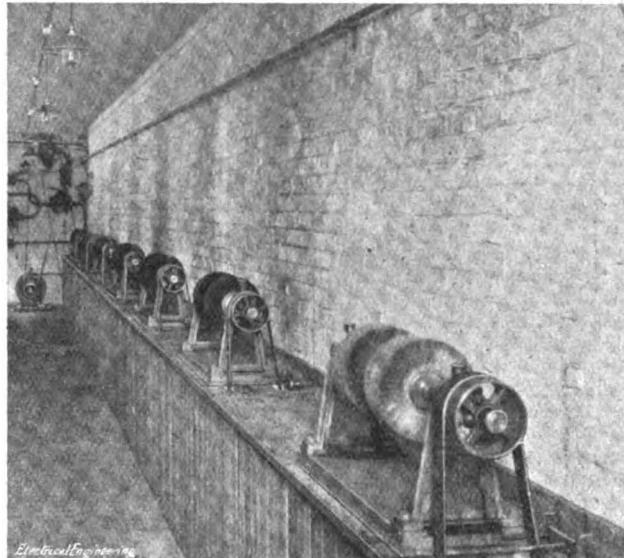


FIG. 7.—BOOT-CLEANING MACHINES.

which is driven by a small motor, and has already been mentioned among the miscellaneous applications of electric power.

There are thirty-eight "Magneta" electric clocks in various parts of the building. This system is one in which no batteries are employed. Impulses are transmitted to the dials every minute from a weight-driven master clock. This clock contains a device consisting of a bobbin with a pivoted core lying between the poles of a horse-shoe permanent magnet. This is oscillated rapidly through an angle of 45° every minute by means of mechanism connected to the clock movement, and the direction of the lines of force through the bobbin is reversed and a momentary current is sent through the dial circuits.

Time-stamps are used in various departments—twenty in all—and the clocks of these are also electrically operated from a master clock and a relay. These are independent of the electric clocks already referred to and were supplied by Rusmold's, Ltd. This system is battery-controlled on the clock side and impulses are sent by the relay every minute.

Reinforcement of Electric Light Trenches.—The question of the reinstatement of the trenches in which electric light mains are laid has been receiving considerable attention at the hands of road authorities for some time past. As the law stands at present, electric supply companies or municipal electric supply departments have to reinstate the trenches themselves and maintain them in a good condition for twelve months afterwards. In many places it has been found that this system is not satisfactory, and not infrequently arrangements are made with the road authorities to reinstate the surface of the roadway after the electric supply authority has filled in the trench. This, however, still involves certain difficulties due to subsidences in the road surface, and a strong feeling now exists that Parliamentary authority should be given to road authorities to do the whole of the filling in and reinstatement after the supply authority has merely laid the mains. Obviously, general legislation applied to all the country would be the best, but one county council, probably foreseeing difficulties in this direction for some little while to come, is endeavouring to obtain these powers for itself by means of clauses in private Acts of Parliament promoted by companies or local authorities as the opportunity arises from time to time. The matter was a subject of discussion at the annual meeting of the Institution of Municipal and County Engineers last week.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

ELECTRICITY IN MINING IN AMERICA

A GENERAL survey of the use of electricity in mines relating principally to American practice is given by Mr. D. B. Rushmore in the *General Electric Review*. Dealing with mining in its widest sense, the author writes that "due to the fact that a large number of mines in one locality have use for power and that in each mine the machinery is separated by considerable distances, the use of electricity as a means of transmission and application of power has very decided advantages. In fact, the age is passed when advocacy of electrification of mines has to be put forward as regards new developments. The replacement of antiquated machinery in mines which have been worked well on toward exhaustion is, however, an economic problem which does not always admit of the introduction of electrical apparatus at such a late period."

He points out that the question whether a mine should generate or purchase its power is a local condition and the size of the undertaking, but insists particularly on the possibilities electrical methods open up in the generation of power at the pit from qualities of coal unmarketable except when made up into briquettes, instancing the 80,000-kw. plant of the Lehigh Coal & Navigation Co. at Haute, Pa., as an example.

Dealing first more particularly with gold and other metal mining, he refers to the large developments of the electrically-worked shovel or excavator built on the lines of the "steam navvy" long familiar in this country. These shovels are, as a rule, equipped with three or four motors; one or two for the hoist, one for the swing and one for the boom. The two hoisting motors are located at the back of the main machinery, and longitudinally in relation to the car-frame, one on each side, and transmit their power to an intermediate hoisting shaft through bevel gears. This intermediate shaft gears direct into the hoisting drum shaft which carries the drum on which the hoisting chain is wound, this drum being provided with friction and check bands for controlling the hoisting and lowering of the dipper. The swinging motor is geared to the swinging drum through a system of spur gearing, this drum carrying two cables, one on either end, which lead forward and pass round the swinging circle connecting directly to the boom. This motor is provided with a brake, used in case of emergency. The boom motor for controlling the dipper handle is located on the boom and geared to the shipper shaft, which carries two pinions which engage with the racking of the handle. Continuous-current series motors give the best results, and the control is usually by contactors and master controllers. It is stated that a consumption of 0·241 kw.-hours is required per cubic yard under good conditions, and a very marked saving in cost is effected over steam driving. Another extensive field for electric power is in the driving of gold dredges, of which well over 100 are already in use. The bucket type is most commonly used. The machinery of a gold dredge consists of the bucket line, revolving screens, sluice tables and boxes, stacker for carrying the tailings, high and low pressure pumps. Dredge motors are mostly of the alternating-current class, the variable speed type being required for the operation of the bucket line as well as for the winch by which the dredge is kept in place or moved about. All the other motors are of the constant speed type, with the screen and stacker motors usually phase-wound. Bucket-line motors vary in size from 75 to 400 h.p., winch and stacker motors from 15 to 50 h.p., and screen and pump motors from 25 to 150 h.p. The power is transmitted to the dredges by means of armoured cable, carried on floats, and if the transmission can be economically carried out at 2,300 volts, the motors are usually wound for this voltage. For higher transmission pressures step-down transformers are, however, provided on the dredge and the pressure reduced to a motor voltage of 440.

Electric coal-cutters were first adopted in America on a commercial scale about the year 1891, and in 1912 over 15,000 were in use, cutting 47 per cent. of the total produc-

tion. The types in use do not differ in general features from those employed in this country.

The great difference between American and British underground haulage arrangements is the much more extended use of underground locomotives in the United States. These are now principally electric locomotives, although a small proportion of compressed air and petrol machines are still in use. They are usually equipped with two motors with series parallel control, and are made in sizes from 4 to 20 tons of remarkably compact design. Locomotives used for gathering are generally of a smaller capacity than those used for the main haulage. In order to obviate the use of trolley wires in the entries, these locomotives are often equipped with cable reels, containing several hundred feet of cable, the outer end of which can be connected to the trolley wire in the main entries, and through which power may be fed to the locomotive when it enters the working rooms. The cable reel is motor-operated and automatically controlled in such a manner as to keep the cable taut and rewind it when the locomotive returns. Some gathering locomotives are also in addition provided with hoist drums to be used for steep grades. There has also been a steady increased demand for the storage-battery type of locomotive for gathering work, these being built in sizes from 3 to 7 tons.

Electric winders (or, as they are more usually called in America, "electric mine hoists") were, as Mr. Rushmore points out, "first developed in Europe, and their use there had become universal before the mining interests in this country were ready to adopt them. After a campaign of education lasting over several years, their adoption in this country [America] came with unusual rapidity, and now it is only under exceptional circumstances that any other kind of hoist would be considered." Both the three-phase and continuous-current equaliser systems are employed. The author comments further on the uses of electric power in pumping and ventilation, but no distinctive features are revealed.

Finally, some statistics are given from which the following figures may be extracted to give an idea of the magnitude of the application of electrical engineering in American mining:—

| | All Mining Industries | Anthracite Coal. | Bituminous Coal. |
|--|-----------------------|------------------|------------------|
| Number of Mines, etc. | 198,688 | 429 | 6,068 |
| Total H.P. of Motors | 728,727 | 47,498 | 354,882 |
| H.P. Worked by Purchased Power | 216,108 | 1,410 | 25,294 |
| H.P. Worked by Generated Power | 14,842 | 1,152 | 9,720 |

In another part of the article it is mentioned that 510 million tons of coal were mined in America in 1914.

ACCIDENTAL SHOT-FIRING BY LIGHTNING

A N instance of trouble being experienced in the shot-firing circuits of mines due to lightning is recorded in a Paper by M. Ferez before the Société de l'Industrie Minérale, which is referred to in the *Colliery Guardian*. The mines in question, at Rochabell and Fontanes, in France, are provided with a central system of shot-firing, by which all shots are fired from a station at the pit-head after the men have been withdrawn. In some cases 30 to 50 shots at a distance of two kilometres from the firing point are exploded, and current from the 120-volt lighting circuit is employed for the purpose, the detonators in each working place being connected in series. On several occasions accidents occurred through shots going off by themselves when the control board was not even connected to the mains. In order to provide against the recurrence of such incidents, it was decided to cut the lines at the point where they passed from the shafts to the roadways, connection being made by the onsets some moments before firing took place.

They were disconnected by the workmen deputed to carry out the examination after the firing of the shots. The following measures were taken in addition. When the wire was disconnected at the pit-eye, the shaft conductors were at the same time connected with earth, a copper wire serving, before and after shot-firing, to connect each shaft conductor to the firing circuit or to earth respectively. This was replaced by a two-way switch, and by a flexible cable terminated by a brass contact, so adapted as to be connected up with a contact soldered or bolted on to the extremity of the wire extending into the mine, or to a contact with earth. A gap was thus secured of about 1 m. Certain improvements were subsequently made in the control board and insulated cables were substituted in the shafts for the bare wires on insulators previously in use, but the trouble occurred again during a storm. The management accordingly decided to establish a second gap, similar to that at the pit-eye, at a distance of about 100 m. from each of the workings. It was further decided to sectionalise each branch line by means of a gap placed at the entry of the quarter served by it, and placed as near to the workings as possible. The disconnection is made, and the wire earthed by the men carrying out the examination, and the connection is effected as nearly as possible at the end of the shift by the last workmen to go out. The effect is to diminish the capacity of the wires and the inductive influence of the atmosphere. In accordance with the mining regulations, a return wire is necessitated, and the wires will be completely insulated.

ELECTRICAL MINING AND METALLURGICAL PATENTS OF JUNE

Mining.

In Specification No. 12,885 of 1914, E. C. Theedham describes a mine-signalling apparatus, in which the handle of the transmitting key has to be partially rotated before being pushed in to make the signal. This partial rotation closes a circuit, and thus resets the indicator which has recorded the last signal, so that it is ready to record the signal about to be made. It is therefore impossible to give one signal on the top of another.

G. B. Burrows, in Specification No. 13,310/14, describes a system of electric signals for main-and-tail haulage in mines by means of current from the power or lighting mains suitably transformed. The principal feature is a series of signalling stations at junctions and terminal points equipped with means for transmitting aural signals to distant stations, and at the same time indicating in a visual manner at the sending station, and arranged so that the visual signals confirm the receipt of the aural signals. Means are also provided for indicating the sending station in the engine-room.

Electro-metallurgical.

In Specification No. 11,950 of 1914, A. M. Hanriot describes an electrolyte process for extraction by electricity of the metals silver, copper, and mercury from their ores, silver chloride, copper glance, and cinnabar respectively. These ores are placed in contact with the cathode in a conducting bath of alkaline salts, and the metal appears at the same place as it occupied in the ore.

A process for the reduction of complex sulphide ores in the electric furnace is described in Specification No. 4,937 of 1914 by F. W. Highfield. The ore, after having been roasted to remove sulphur and mixed with a reducing agent, is heated in a special form of three-phase resistance furnace in a reducing atmosphere to a temperature (about 950° C.) at which zinc is volatilised but lead is not, so that the lead can be run off in a liquid condition and the remaining matter heated electrically to the heat of formation of silicious slags (about 1,300° C.). The copper and iron sulphides can be further decomposed in the same furnace by the action of a continuous current. The furnace employed is described in more detail in Specification No. 2,728 of 1915 by the same inventor. It has a cast-iron body lined with silica and with an inner lining of magnesite or other second-class conductor. There are three water-cooled electrodes 120° apart at the sides for the main three-phase heating current, and separate electrodes for the continuous-current for the further electrolytic reduction. One of these, of a carbonaceous character, is in the centre of the bottom of the bath, and the other, also water-cooled, is suspended from the roof.

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QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,449.

At present, owing to the war, it is difficult to obtain supplies of small dry batteries used for pocket flash lamps. Is there any good and simple way of refilling the used cells?—"Lux."

(Replies must be received not later than first post, Thursday, July 8th.)

ANSWERS TO No. 1,447.

Why have the so-called "non-arcing metals" not been generally adopted for fuse-wire?

The first award (10s.) is given to "C. H. W." for the following reply:—

The non-arcing metals—certain brasses, zinc, cadmium, bismuth, mercury, &c.—are so called on account of the fact that an alternating current arc cannot easily be maintained across a short gap between electrodes made of such metals. The Wurtz multigap lightning arrester consists of a number of short air gaps in series between non-arcing metal electrodes: The number of short gaps making a total gap sufficient to hold the line voltage. Wurtz found that if the gaps are long, say half-inch, the short circuit may be maintained, that is, the arc will not necessarily be suppressed. The necessity for the gap to be kept very short, and for the electrodes to be massive in order to get rid of heat, makes it difficult to employ fuse-wire of non-arcing metal. For if such a fuse-wire of ordinary length melted at a point along its length, the non-arcing electrodes formed of the remainder would be of small mass, and the gap would be too large. It might conceivably be possible to employ an exceedingly short non-arcing fuse wire between fairly massive non-arcing electrodes, but there still remains the difficulty that it is only alternating arcs which are suppressed. For direct current these metals would not be effective, as shown by the following considerations. While the vapours of mercury, zinc, &c., are good conductors when the current is passing through them, they become practically insulators when the current ceases at the end of the half wave. Hence it is that the arc cannot be restarted by the next half wave of voltage unless there is impressed a very high initial voltage to break the gap down. Thus for ordinary circuit voltages the arc ceases at the end of the first half wave of current. With carbon electrodes, owing to the high boiling point, the vapour being at a high temperature remains fairly conducting after the current has ceased, owing to the current wave going to zero value. Thus the arc can be restarted by the next half wave of voltage without any necessity for a high "breaking down" pressure. It will be seen from this short explanation that the non-arcing properties of mercury, zinc, &c., are confined to alternating-current circuits.

The second award (5s.) is made to "L. R.," whose reply is given in slightly abbreviated form below:—

Although the non-arcing property of certain metals is valuable from the fuse point of view, and although these metals possess certain other useful properties common with the arcing metals, yet on the whole the disadvantages outweigh the advantages. With some non-arcing metals, viz., with zinc and cadmium, mechanical weakness is found, and they cannot be obtained satisfactorily in the form of wire. With aluminium,

although these difficulties are overcome, special spring arrangements may have to be used to make a satisfactory fuse. The non-arcing metals generally speaking are oxidising metals, and are capable of forming oxide sheaths strong enough to hold up the metal after fusion, so that in some cases a sheath is formed which contains molten metal, and this permits the passage of current after the fuse has theoretically blown. Other points have also to be noted, as, for instance, the surface tension of the molten metal as influencing the globules formed, and whether the globules burn in air or not quite apart from the non-arcing properties of the metal.

The boiling points of lead, tin and zinc are approximately 1,000° C., and it is certain that many of the globules of these metals scattered on disruption approximate to this temperature. In general it may be taken that the mass of metal in a fuse should be as small as possible. The kind of difference obtained with various metals from the no-arcing point is as follows, taking a fusing current of about 40 amperes:—Copper wire, minimum no-arc length, 4½ in., and zinc strip, 3 in. This varies somewhat according to the voltage, short-circuit current, and the inductance of the circuit, but under the same conditions in open type fuses the minimum no-arc length for zinc is always decidedly less than copper. Zinc blows fairly cleanly, the molten metal is not scattered far, but occasionally globules show a tendency to continue to burn in air where they fall. On the whole, therefore, it is a good material from a short-circuit point of view. With enclosed fuses on the other hand the minimum no-arc length is found to be somewhat greater for zinc than for copper, viz., for the 40-ampere fuse, zinc strip, 2 in., copper 1·3 in. This is due to the greater mass of metal involved for a fuse of given capacity, and to the molten metal being confined by the filling. Possibly, also to the metal vapour not being so quickly oxidised as when the fuse is in air. Zinc, again, gives rise to a high inductive voltage rise at the breaking of the circuit, and the arc formed (even with non-arcing metals there is always really some instantaneous arc formation), is unstable. Further, the inductive pressure rise seems to be irregular, and the break is sluggish. On the whole the same applies to aluminium, the inductive voltage curve being usually very peaked, although sometimes the total rise is not very high, and the arc persists for a longer period. Cadmium is very similar to zinc, the maximum voltage rise being rather greater, and it takes a considerable time to die away. It is better than copper from the point of view of the duration of the arc. All the no-arcing metals are comparatively sluggish, and this is accentuated with an enclosed fuse, the greatest difference in time element being, say, between an open fuse of copper and an enclosed fuse of a sluggish metal, such as tin or zinc. Thus the non-arcing metals are not sensitive as fuses. Silver and copper yield the quick-acting fuses, while lead, tin and zinc the slow-acting, and of these last three, zinc is the slowest, but as it has the least mass the amount of metal scattered when the fuse is blown is less than in the case of lead and tin. Tin is the most economical metal to use, then come silver, aluminium (with spring attachment), copper, and aluminium without spring, in the order named.

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING JULY 10TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

On Mondays, Wednesdays, and Fridays, drills at 6.30 and 7.30 p.m. Technical instruction will be given by instructors of the London Electrical Engineers for one hour, and squad and platoon instruction for one hour on Monday and Wednesday. On Friday, company and squad drill. *Orderly Sergeant*, H. N. Fullerton. *Recruit Orderlies*, Squad 3:—C. F. McInnes, Squad 4:—W. H. G. Saunt.

E. G. FLEMING.

(*Company Commander and Acting Adjutant.*)
The Temporary Headquarters are at Marconi House, Strand, W.C. (Tel.: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W.

Employment of Disabled Sailors and Soldiers.—The Council of the Institution of Electrical Engineers desire to call attention to the demand for employment from disabled sailors and soldiers. The number at present requiring employment is not very large, but it may increase considerably during the next few months. The Committee, which deals with the question of the employment of these men, is the Association for the Employment of Ex-Soldiers, 119 Victoria Street, Westminster, London, S.W., to whom all applications for further information and lists of the local branches of the Association should be addressed. Many of the men could, no doubt, after some training, do useful work as switchboard attendants. Attention is also drawn to the Report of the Local Government Board Committee upon the provision of employment for sailors and soldiers disabled in the war, copies of which can be obtained from any bookseller, at the price of 1½d. each.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published June 24th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

8,683/14. Repairing Lamps. ELECTRICAL UTILITY Co. and R. W. LONG. A method of repairing a broken incandescent lamp which consists in removing the hub from the brass cap, cutting through the hub transversely at about the middle part of its length, and sealing to the cut surface of the flanged portion of the hub a counterpart of the hub that has been cut off.

10,930/14. Immersion Heaters. A. HOWARD. An improved form of immersion heater of the class in which the liquid is heated by alternating current actually passing through it between concentric tubular electrodes. (Two figures.)

13,076/14. Tungsten Filaments. B.T.-H. Co. (*G.E. Co., U.S.A.*). A method of rendering drawn tungsten wire capable of taking a permanent set without heating, which consists in heating the wire after drawing in an oxidising atmosphere, and then heating the oxidised wire in an evacuated chamber or in nitrogen or hydrogen with or without water vapour.

13,410/14. Telephony. M. S. CONNER and R. E. ROBINSON. In connection with branch exchange switchboards of the battery signalling type, junction circuits between the main and the private branch exchange and relays associated with these circuits arranged so that when a main exchange subscriber is connected through one of the junction lines to a private branch subscriber and the latter hangs up his receiver, clearing signals are simultaneously operated, one at the main exchange and one at the branch exchange, the signal at the branch exchange being located in the junction line circuit. (Five figures.)

13,709/14. Starting A.C. Motors. W. E. M. AYRES. Starting apparatus for slip-ring induction motors, comprising mesh connected resistances for the rotor phase windings and a controller arranged to short-circuit portions of the resistance in each of two phases alternately, no portion of the resistance in the third phase being short-circuited. (Five figures.)

14,229/14. Shaping Metal Filaments. B.T.-H. Co. (*G.E. Co., U.S.A.*). A method of giving a zigzag shape to continuous filaments consisting in winding a number of turns of the wire, each turn of figure 8 form on a pair of conducting supports, and heating the wire by passing current through it from one support to the other. In the case of tungsten the temperature is about 2,000° C. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: MOUL (*Kürtting & Mathiesen A.G.*) [Reflector for arc lamps] 5,345/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WITTRIN [Means of attaching insulators] 5,240/14; BEAVER and CLAREMONT [High voltage cables] 20,549/14.

DYNAMOS, MOTORS AND TRANSFORMERS: BERRY [Transformers] 14,030/14; SCOTT [Armatures] 14,043/14; A. E. G. [Insulation of armature coils] 14,044/14; JEFFCOTT [DYNAMOS] 14,415/14.

Incandescent Lamps: ELECTRIC UTILITY Co. and LONG [Incandescent lamps] 8,684/14.

Instruments and Meters: SIEMENS, SCHUCKERTWERKE GES. [*Meters*] 6,341/14.

Switchgear, Fuses and Fittings: A. E. G. [Feeder switching system] 5,467/14; ADAMS [Lamp holders] 12,059/14; DUNSIFFE [Switches] 14,733/14; CUSTER [Controlling devices] 14,974/14; RAILING and KRAUSE [Fuses] 18,276/14.

Telephony and Telegraphy: SIEMENS & HALSKE A.-G. [Semi-automatic telephones] 19,518/13; BETULANDER and PALMGREN [Automatic telephones] 17,415/14; IMRAY (*Siemens & Halske A.-G.*) [Selectors] 23,930/14; SIEMENS BROS. & CO. (*Siemens & Halske A.-G.*) [Automatic telephones] 24,227/14.

TRACTION: JANSSEN [Current collectors] 6,182/14; SIEMENS BROS. & CO. and FERREIRA [Signalling] 6,520/14; COLAS [Track contact rails] 14,006/14; O'DONNELL and GLENN [Signalling] 14,024/14.

Miscellaneous: MÖLLER [Electrical dust precipitation] 18,357 and 19,732/13; WILLIAMS [Burglar alarms] 11,097/14; WOOLSCROFT and H. T. BOOTHROYD, LTD. [Connectors] 11,156/14; SIEMENS, SCHUCKERTWERKE GES. [Cooling of electric drilling machines] 14,022/14; HILL (*Apparate-Bauanstalt Fischer Ges.*) 17,797/14; CADENEL [Electric locking devices] 8,060/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: A. E. G. [Arc lamp with tungsten electrodes] 8,272/15.

DYNAMOS, MOTORS, &c.: SIEMENS, SCHUCKERTWERKE GES [Slot-closing devices] 7,923/15; BRESLAUER [Unipolar driving system] 8,334/15.

Telephony: TURRI [Telephone instruments] 7,963/15; GES FÜR DRAHTLOSE TELEGRAPHIE [Wireless receivers] 7,358/15.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:-

13,468/01. Railway Signalling. WESTINGHOUSE BRAKE Co. and E. DE M. MALAN. A system of electrically interlocking railway signal levers.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, and TRANSFORMERS: MAVOR and COULSON and H. A. MAVOR [Induction motors with primary and secondary both capable of rotation] 5,926/04; R. D. MERSHON [Induction motor control] 5,564, 5,564A, and 5,565/07.

Incandescent Lamps: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Filament cutting-off machines] 5,576/07.

Instruments and Meters: V. A. ARCIOMI [*Meters*] 5,891/02.

Switchgear, Fuses, and Fittings: SIEMENS BROTHERS & CO. (*Siemens & Halske*) [Cartridge fuses] 5,802/02; A. P., C. G., and P. A. LUNDBERG [Tumbler switches] 5,826/07.

Telephony and Telegraphy: C. WIRTH [Wireless selector] 5,811/09.

Miscellaneous: H. LELARGE [Separator depending on conductivity] 5,799/04; C. O. BÄSTIAN [Mercury vapour lamps] 5,892/04; A. ZÜND [Electric aural massage] 4,525/07; W. D. WHYTE [Magnetic compass] 5,068/08; H. GRAY [Cables] 5,199/08.

Diesel Engine Users' Association.—At the June meeting of this Association the question of a suitable allowance for depreciation of Diesel engine plant in connection with income-tax assessment was considered. It was generally felt that the present practice of allowing only 5 per cent. for depreciation, and that only on the diminishing capital value, was quite insufficient for the purpose. A somewhat larger percentage had recently been offered in the case of the Diesel engine plant of an electrical undertaking, but the increase offered was only small, and it was thought that if Diesel engine users generally would take some action in the matter, and protest against the inadequacy of the present allowance, the income-tax authorities might be persuaded that a more liberal treatment in this respect was only just and reasonable. After some discussion the question was adjourned for further consideration.

The next meeting of the Association is to be held on Wednesday, July 21st, when the questions of lubrication and of cracked pistons are to be further discussed. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, 19 Cadogan Gardens, London, S.W.

Relationship between Production and Sales Departments.—On the 17th inst., at the last meeting of the Sales Managers' Association before the summer adjournment, Mr. H. Williams read a Paper on this subject. He emphasised the necessity for co-operation between the outdoor selling staff and the office staff, and suggested that greater financial accommodation towards customers in the future than has been the case in the past on the part of British traders will be a dominating factor in our trade. One of the reasons of the success of Germans in trade had been the extraordinary terms of credit they were prepared to give. Many of the suggestions put forward were mere elementary truths, but it cannot be disguised that their existence in many cases seems unknown, judging by the methods that are sometimes employed. A number of speakers took part in the subsequent discussion.

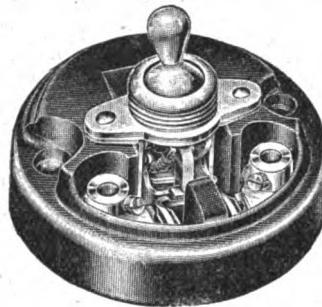
Obituary: Killed in Action.—We regret to hear that three members of the staff of the County of London Electric Supply Co. have been killed in action. Mr. A. P. Featherstonhaugh, who had been with the company 14½ years, was a sergeant in the London Rifle Brigade, Mr. G. Boast was serving in the 23rd County of London Regiment, and Mr. P. G. M. Brown was in the London Rifle Brigade.

We regret to record the death, at the age of 83, of Mr. C. E. Spagnoletti, a Past-President of the Institution of Electrical Engineers, who was one of the pioneers in the electrical industry and the founder of the well-known engineering firm bearing his name, which was recently converted into the Park Royal Engineering Works, Ltd.

A QUICK-BREAK AND QUICK-MAKE SWITCH

WE illustrate here a new pattern of quick make and break tumbler switch that has just been put on the market by J. H. Tucker & Co. (King's Road, Hay Mills, Birmingham) in response to a demand which has existed for some time from consulting engineers. The new switch is uniform in size and external appearance with our standard flat type switches. The diameter of the base is 2½ in., whilst the over-all projection is only 1½ in.

The movement is of simple, sound construction, and a positive action is obtained in the initial opening and closing of the switch. The contacts are of special design to obtain great flexibility and reliability of contact. Micanite only is used throughout for insulation, whilst the bases are of highly

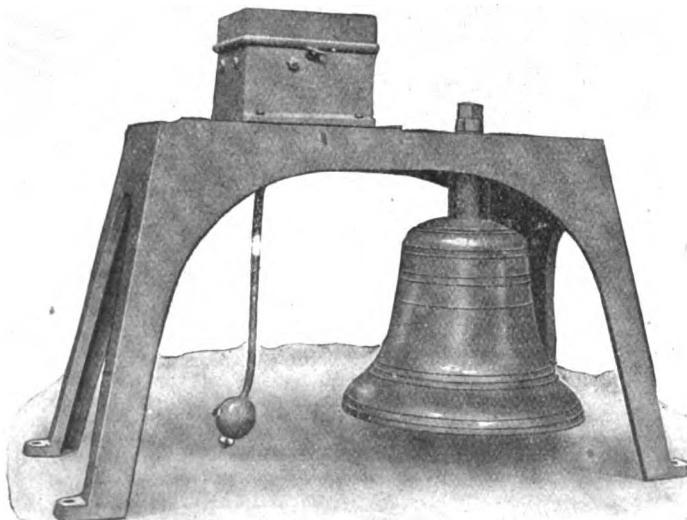


QUICK MAKE AND BREAK
TUMBLER SWITCH.

vitrified porcelain. The switch-knob is in the same relative position when the switch is "on" or "off" as the knob of the ordinary tumbler switch, and there is, therefore, no confusion to be expected in this respect. It is the firm's invariable custom before placing any new apparatus on the market to submit same to very stringent tests in their works. We are informed that the movement of this particular switch has been mechanically operated on test for over 2,000,000 times without breaking down. Switches with quick "make" and "break" movement are now ready in the ordinary "one-way" form, and also in the "two-way," with china or brass covers, in either plain or fancy forms and in many different styles of finish.

ELECTRIC BELLS AND ACCESSORIES

A NEW edition has just made its appearance of the catalogue of electric bells and accessories of the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), which is a very complete production, containing prices and particulars of a very large number of types of bells of the ordinary trembler, single-stroke, and relay patterns, as well



LARGE PATTERN OF ELECTRIC TOLLING BELL.

as large tolling bells for works, fire alarms, &c., up to the 4-cwt. bell illustrated here. The special designs include watertight and gastight bells, tramcar bells, &c. The variety of indicators is as great as that of the bells, and a still greater number of designs of pushes are listed. Among special apparatus may be mentioned a wind-direction indica-

tor, transformer for working bells, &c., from A.C. mains, and relays for special purposes. The list also contains burglar-alarm apparatus, lightning conductors, mine exploders, and other apparatus, and a full range of wet and dry batteries forms a prominent feature.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Darlington.—A L.G.B. inquiry was held last week concerning a loan of £34,950 for extensions to the electricity undertaking. In support of the application, a representative of the North Eastern Railway Co. gave evidence that the Company's North Road shops, which are steam-driven, are to be converted to electric drive; that the shops are employed on Government work; and that this would probably be increased very shortly. The Inspector elicited the fact that of the amount asked for, £11,000 are required for mains and services during the next three years, but the Town Clerk assured the Inspector that there was no intention to spend a penny on mains that could be avoided.

London: Stepney.—The Finance Committee of the L.C.C. recommends sanction to a loan of £24,000 for additional boiler and engine house plant.

Manchester.—Sanction has been received to the borrowing of £432,470 for carrying out the first section of the new Barton power station.

Mansfield.—Sanction has been given to a loan of £2,000 for plant in connection with supply to the military camp.

Stalybridge.—The Joint Board has received sanction to borrow £4,000 for mains and transformers.

Wiring

Edinburgh.—Electric lighting of public washhouse, M'Leod Street. City Electrical Engineer, Dewar Place.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aldershot.—Additional block at Isolation Hospital. Borough Surveyor.

Bury.—Sanatorium. Clerk, Joint Hospital Board.

Castleton.—Extensions to works, Ormerod & Sons.

Ely.—Isolation Hospital. Architect, S. J. Wearing, 15 Upper King Street, Norwich, or City Surveyor, Ely.

Hanwell.—Isolation hospital (£4,000).

Harrogate.—New art and music rooms at Ashville College. Architect, James Hartley, Skipton.

London.—Enlargement of Royal Free Hospital (£30,000).

Malvern.—New school.

Manchester.—Reconstruction of Union Mill, Audenshaw, after fire. Proprietors, J. & W. Hamer.

Paignton.—Extensions to Isolation Hospital (£2,500).

Rushden.—New school.

Scarborough.—Business premises, corner of Queen and Market Streets. Architect, J. C. Petch, Bar Chambers.

Sunderland.—Considerable extensions at Borough Sanatorium, Hylton Road. Borough Surveyor.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Oldham.—The tender of the Corporation Electricity Department for lighting the Higinshaw School has been accepted at £200. Our local correspondent states that a good deal of annoyance has been caused among electrical contractors in Oldham by this decision of the Education Committee, and particularly with the remark of one local councillor, that he did not know of any local contractor who could do the work. It is probable that the matter will be raised at the next meeting of the Corporation, as it is regarded not so much as a matter of municipal trading, but as an instance of one municipal department helping or "obliging" another.

Salford.—A contract for a 1,000-kw. rotary converter and transformer at £2,820 has been placed with the British Westinghouse Co. W. T. Glover & Co. are to supply H.T. cable to the approximate value of £1,457.

APPOINTMENTS AND PERSONAL NOTES

The City of Dundee Fortress Engineers (1st Company), under the command of Captain H. Richardson, City Electrical Engineer to the city, got an enthusiastic send-off on Tuesday afternoon when they left for France. Headed by the Royal Scots Band, they marched from headquarters to the station, where the departure was witnessed by a large crowd, including the Headquarters Staff, Captain Richardson's brother officials of the city, the Lord Provost and Town Councillors, and the chief members of the staff of the Electricity Works.

Mr. W. J. Cridge, who joined the Queen's Westminster Rifles in November last, has been gazetted as Second Lieutenant in the Sherwood Foresters.

Mr. R. H. Cridge has received an appointment in the control gear section of the British Westinghouse Electric & Manufacturing Co., Ltd. (Trafford Park, Manchester).

With reference to our Note last week to the effect that Mr. Cameron Gibson, Borough Electrical Engineer at Nuneaton, had joined the Forces, it was reported at the last meeting of the Council that Mr. Gibson had been appointed Lieut.-Commander, R.N.V.R., and it was decided to allow him £200 per annum during his absence, this allowance to be modified in the event of promotion to higher rank.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £94 10s. to £95 10s. (last week, £95 to £96).

Advance in Prices.—The General Electric Co. give notice of the following advances on their list prices:—Fittings, 20 per cent.; fittings accessories, 50 per cent.; heating and cooking apparatus, 20 per cent.; and lanterns, 20 per cent.

The Bastian Meter Co., Ltd., have been compelled to advance their prices by 20 per cent.

LOCAL NOTES

Bradford: Satisfactory Electricity Profits.—The net profit on the electricity undertaking last year was £18,955, an increase of £4,050 over the preceding year.

Dublin: Increase in Electricity Charges.—In dealing with a proposal to increase the electricity charges last week, the Chairman of the Electricity Committee said the point which had to be considered was whether the consumers should be asked to pay extra or whether a deficit of £21,000 should go on to rates. Having considered the matter very carefully, the Committee proposed to increase the lighting charge by 1d. per unit and the power charge by 1d. per unit. There was a long discussion, and eventually the recommendation was carried by 34 votes to 11.

Glasgow: Smoke Abatement Exhibition.—A Smoke Abatement Exhibition is to be held in the Exhibition Hall, New City Road, from Sept. 23rd to Oct. 16th, under the patronage of the Corporation. The preliminary classification of exhibits includes, of course, electric lighting, heating, cooking, and power. Mr. James M. Freer, 38 Bath Street, is Manager.

London: Hampstead: Decreased Electricity Receipts.—



The net income of the Electricity Department last year was £69,724, or £2,163 less than the previous year. The net profit was £2,766, compared with £6,258 in the previous twelve months. Mr. W. Wyld, Chief Electrical Engineer and Manager, reports that the number of consumers being charged upon the maximum-demand system continues to decline, the flat rate being more popular. A gratifying increase in the supply of energy for power, heating, and cooking is taking place. The policy of hiring out apparatus continues to meet with success, the number of heaters having increased from 101 to 200 in the twelve months, cookers from 24 to 55, motors from 5 to 18, and miscellaneous apparatus, such as fans, &c., from 9 to 28.

Fulham: The Linking-up Scheme.—The linking-up scheme between Fulham, Hammersmith, and Battersea, referred to on p. 258 of our issue of June 17th, has received the sanction of the Council.

Poplar: Large Electricity Profits.—In the course of a debate at the I.M.E.A. meeting this year on the "Point-Five" tariff, Mr. H. W. Bowden, the Borough Electrical Engineer, mentioned the very satisfactory figures of profit which his undertaking showed for the past year. The accounts which have just come to hand bear this out. The net profit after providing for capital charges and a number of miscellaneous items amounting to £1,435 was £14,749, compared with £8,010 in the previous twelve months. Adding to this the unappropriated balance from last year's accounts, there is a net available surplus of £19,966, and of this £9,346 are recommended for allocation to a large number of details, many of which are of a capital nature. It is proposed to keep in hand a working balance of 10 per cent. of the total income and leaving a sum of £5,785. Of this Mr. Bowden recommends that a part should be retained in hand for at least six months in view of the war. It is interesting to note in the accounts that the reciprocal supply with Stepney is the dominating factor in the improvement of the efficiency of the system from 80·98 to 81·37 per cent. by saving works units when shut down. This agreement will obviate the necessity for further extensions until the maximum demand upon the Poplar undertaking has reached 10,000 kw., and allows for an output of 25 million units per annum, which will probably answer all demands until the winter of 1917.

Stoke Newington: New Loan.—A loan of £4,000 has been sanctioned by the L.C.C. for mains and meters.

Northampton: Objections to New Power Station.—The proposal recently mentioned in our columns of the Northampton Electric Light & Power Co. to erect a new power station has been objected to by a number of people, including the Corporation, on various grounds. It is proposed to erect the new power station just outside the Borough boundary, and there were the usual objections from residents on aesthetic grounds. These, however, judging from the remarks of Mr. A. P. Trotter, who held an inquiry into the matter last week, are not likely to have much weight. The chief objection, however, comes from the Corporation on the ground that, if erected, the new power station, which would constitute the Company's chief works, would be outside the Borough and affect the rateable value of the existing property of the Company inside the Borough. Mr. Trotter did not think that the question of the rateable value could be gone into, but only the matter of nuisance likely to arise from the works. All the objectors having been heard, the inquiry was closed.

Salford: Meeting Cost of Extensions.—The Finance Committee, reporting upon the Electricity Committee's recommendation to spend £19,225 for new plant, as mentioned on p. 262 of our issue for June 17th, recommends that the amount be taken from the depreciation and renewals fund, and not borrowed in the ordinary way. At the last meeting of the Corporation this proposition was discussed in private, and eventually was passed by 28 votes to 9.

Swansea: Heaters and Cookers on Loan.—In reporting a profit of £1,786 upon the electricity undertaking last year compared with £3,313 in the previous year, the Borough Electrical Engineer recommends the loaning to consumers of electric heaters and cookers, and further points out the possibilities for development in the use of electric vehicles.

Ediswan v. Siemens' Rifle Competition.—On Saturday last a shooting match between teams of 17 members each, representing the Ediswan and Siemens' rifle clubs, was decided on the Ediswan range by a win for the home team by 1,234 to 973. Spoons were awarded to Mr. Fowler (Siemens), and Mr. Black (Ediswan) for the highest scores of 97 and 91 respectively. Wooden spoons were also given for the two lowest scores.

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SUMMARY

Two articles deal with the new sizes of half-watt lamps which have just been placed upon the market (pp. 294 and 298).

THE action brought by Osram Lamp Works, Ltd., against Pope's Electric Lamp Co., Ltd., is still proceeding (p. 294).

WE give an illustrated description of a 200 h.p. rail car equipped with the Thomas electrical transmission system, destined for New Zealand (p. 295).

A PHENOMENON occurring in the testing of magnetos is discussed in our "Questions and Answers" columns (p. 296).

AMONG the subjects of specifications published at the Patent Office last Thursday are electrical precipitation of dust, etc., from gases, meters, incandescent lamps, transformers, and variable speed motors. A patent for electromagnetic switches is opposed (p. 297).

A 6,000 kw. turbo-alternator, etc., is required at Bristol; mains and services and an alternator at Barking; meters and maximum demand indicators at Melbourne; and machinery oils at Hull (p. 299).

NOTWITHSTANDING the war the accounts of municipal electricity undertakings for the year to March 31st, 1915, which are being gradually published, show on the whole increases in output. At the same time increases in charges are becoming more general, owing to the higher price of coal, labour, etc.—The Edinburgh City Electrical Engineer deprecates refusing to connect new consumers in view of the check this will have upon the development of the undertaking (p. 300).

THE General Electric Co.'s accounts for 1914-15 show a net profit of £138,022, and 10 per cent. is

recommended on the ordinary shares.—No dividend is recommended on the ordinary shares of Crompton & Co. for last year, the balance of £7,691 is carried forward after meeting preference dividend (p. 300).

A Self-closing Circuit-breaker.—A new form of circuit-breaker, which not only opens on overload, but recloses automatically when the short circuit is off, is described in the *Electric Railway Journal*. The main contact brush is moved to the closed position and held closed by the operating coil. In case of an overload the armature of a series coil is raised, and this opens a contact which breaks the circuit of the operating magnet, the latter being held open by a latch until the trip coil operates. After opening the main contact a small index current is permitted to flow around the breakers with high resistance. So long as the resistance of the load circuit is low the index current will be shunted around the trip coil, but if it is increased, enough current will be forced through the low-resistance trip coil to operate the latch and allow the contact arm to close the circuit of the operating coil, thus closing the breaker.

Electrolytic Disinfectants.—A report of the Medical Officer of Health for the Borough of Poplar on the manufacture of disinfecting fluid for the Borough by an electrolytic process records that since the installation of the plant in 1906, 381,794 gallons of fluid have been manufactured at a cost of £401 for electricity and £345 for materials. Various improvements in the plant have been made from time to time, which have improved its efficiency and economy.

Electric Vehicles at the Road Exhibition.—There were several electric vehicles among the exhibits at the National Road Exhibition at the Horticultural Hall last week. Edison Accumulators, Ltd., show a tipping wagon similar to that described in ELECTRICAL ENGINEERING (June 17th, p. 254) in connection with the I.M.E.A. Parade, and also a small electric hoist for short haulage work. The General Vehicle Co., Ltd. (Imperial House, Kingsway) (the leading features of whose cars were also described in the article referred to), took part in the exhibition as well, and showed among other examples of their vehicles an electric 3½-ton chassis equipped with street-watering gear.

The I.E.E. Museum.—The collection of electrical apparatus of historic interest at the Institution of Electrical Engineers is making substantial progress, but is not yet by any means representative of the early days of the electrical industry. The Council invite members and others to help by sending or presenting suitable apparatus which is now out of use. Early forms of electric motors, arc lamps, and measuring instruments are desired, and the Council are in search particularly of a Jablochkoff Alabaster candle-holder.

The late Mr. C. E. Spagnoletti.—At the funeral of the late Mr. C. E. Spagnoletti, Honorary Member and Past-President of the Institution of Electrical Engineers, whose death we recorded in our last issue, at West Hampstead Cemetery last Friday, July 2nd, the Institution was represented by Sir John Snell (President), Professor Carey Foster, F.R.S., Dr. S. P. Thompson, F.R.S., Mr. J. E. Kingsbury, Mr. Roger T. Smith, Mr. H. Hirst, and Mr. P. F. Rowell (Secretary).

Brazil.—We have before us the fourth edition of a handbook on Brazil, just issued (price 7s. 6d.) by Mr. J. C. Oakenfull (c/o Cappelle, 2 Upper Janemount, Cork, Ireland). Although the book is in the main not concerned with electrical or engineering matters, a few pages give brief particulars of some of the hydro-electric power plants, and an indication of some of the conditions to be complied with in obtaining concessions. It appears that there are very large waterfalls still unexploited.

NEW SIZES OF HALF-WATT LAMPS

HERE is already considerable demand for the new sizes of half-watt lamps, advertised by several firms last week. As has been the case in almost every step in improvement in lamp manufacture, the greater benefit is at first obtained by users of low voltage. The private installations at 25 volts, put down in the earlier days after the introduction of the metal-filament lamp, partly to save capital cost of secondary batteries, and partly in order to utilise the smallest candle-powers of metal-filament lamps then available, are now able to obtain a range of half-watt lamps of from 15 to 100 watts. They are fitted with the ordinary bayonet cap, instead of the Edison screw, and are not of abnormal size or shape, the smallest size being 4½ in. long by 2½ in. diameter, and the largest (100 watt) from 6½ to 7½ in. long by 4 in. diameter. In the 50- to 65-watt lamps, of which the smallest size of half-watt lamps has hitherto been 100 watt, 30- and 60-watt lamps are now obtainable. Greater interest will attach, however, to the lamps for ordinary supply station voltages. For 100 to 130 volts there are two new sizes, viz., 60 and 100 watts, measuring about 5½ in. by 3 in., and 6½ in. by 4 in. respectively, and both with bayonet caps. For 200 to 250 volts the new sizes listed are 100, 150, and 200 watts; of these the 100-watt size only is fitted with bayonet caps, the two larger sizes having Edison screw caps. The 100- and 150-watt 200-volt lamps measure about 6½ in. by 4 in., and the 200-watt lamps 8½ in. by 4½ in. The dimensions vary to some extent, according to the different makes of lamps.

All the lamps mentioned are stated to have approximately an efficiency of ½ watt per c.p., so that the candle-powers may be taken roughly as twice the watt ratings. Illustrations of some of the new lamps appear in our Trade Section. It will be seen that in the 100-watt sizes the filaments are in an absolutely horizontal plane, so that the maximum candle-power will be vertically downwards. Argon is, we understand, the inert gas used for filling these lamps.

Considerable progress is being made in the manufacture of half-watt lamps in this country, especially in the larger sizes, but, up to the present, the new sizes appear to be chiefly imported from Holland, under licence. In this connection it is interesting to note that the Dutch and some of the German makers have, for some little time past, been advertising gas-filled lamps of smaller size still at the usual supply station voltages, but investigation will probably show that in nearly all of them the efficiency is by no means half a watt per candle; in some cases it is much nearer one watt per candle. For instance, one German maker announced in the last two June issues of the *Elektrotechnische Zeitschrift* that they have introduced a new gas-filled lamp with a bulb not very different in size and shape from that of the ordinary tungsten lamp, and its filament placed in a horizontal plane; the smallest size in 100- to 130-volt lamps is 40 watts, but the mean spherical candle-power of this lamp is only 45 Hefner, and the candle-power in a line with the axis of the lamp 55 Hefner. The 200- to 250-volt lamps of this type are 75 and 110 watt, having mean spherical candle-powers of 80 and 110 Hefner respectively, and candle-powers in an axial direction of 100 and 140 Hefner respectively.

THE OSRAM v. POPE PATENT ACTION

THE hearing of this case has continued before Mr. Justice Joyce since our last issue. When we went to press last week Sir James Dewar was giving evidence for the Osram Lamp Works, Ltd., and the only other witness called for the plaintiffs in the action was Dr. Otto Oberlander, who also generally confirmed the evidence given by Dr. Passmore.

Mr. H. Colefax, K.C., then addressed the Court. He said there was no contest between the parties that carbon is chemically removed, according to the process used by the Pope Co., but whereas the Pope Co. maintained that the carbon was present in the filament carbide of tungsten, and was oxidised through the agency of the oxygen in the tungsten oxide, the Osram argument was that the carbide or free carbon was removed by the oxygen in the steam. Whether the Judge assumed that the defendants were right or not, there would still be a case for consideration as to whether they escaped infringement. The cross-examination of the plaintiffs' witnesses had raised one or two points on this question of infringement. The Pope Co. seemed to think that the carbonising was a separate and distinct step from any step in which carbon was removed as carbonic oxide. Another point was that the defendants did not

pass a current through their filaments to raise them to a high temperature, but adopted as the source of heat an electric furnace in which they heated the filaments externally, whilst a third point was the suggestion that the Just & Hanaman specification called for a soft paste as contrasted with a hard paste used by the defendants. There was, however, nothing in the specification which tied the patentee down to either form of paste, nor did it matter what method of heating was adopted. The plaintiffs' experiments with the defendants' process had shown the presence of hydrogen and steam at each and every stage of carbonisation, and they got absolutely all that the specification detailed. The defendants had made no attempt to see whether water was present; they had the means for doing so, but had relied entirely upon theory to rebut the case for infringement. The plaintiffs' experiments with the defendants' process, on the other hand, had shown that hydrogen was present and that carbon was being removed.

This closed the case for the Osram Lamp Works, Ltd.

Mr. Hughes, K.C., in opening the case for the defendants, put forward the points that the defendants in their process used a hard paste where the Just & Hanaman specification referred to a soft paste, and that the filaments were heated externally and not by means of passing an electric current through them. This latter, he contended, was an improvement on the Just & Hanaman patent in that it facilitated manufacture because bundles of filaments could be dealt with at once instead of each filament separately. Furthermore, there was greater risk of unevenness in thickness of soft paste filaments. He was not at all sure that this in itself would not have constituted subject matter for a new patent. Again, the hydrogen used in the Pope process was absolutely dry; it was purchased in a moist state, but all the moisture was taken out. When the plaintiffs started their action for infringement in October, 1913, they did not know in the least what the Pope process was, but in 1914 they discovered that the result obtained was not produced by the passage of an electric current through the filaments, and that the hydrogen used was absolutely dry. He could not help feeling that this must have been startling, as also must have been their discovery of the alternative process of manufacture in vacuo. Consequently a number of distinguished men of science had been called upon to find a theory to fit the facts as they were found. The theory which had been put forward was, to say the least, extravagant, for it came to saying that although the defendants used dry hydrogen, and that water was produced in the course of the process, consequently the filaments were treated in an atmosphere of steam and hydrogen. He contended that it could not be put forward as infringement, inasmuch as if any water was produced it was a result of the process, and not a necessary item with which to begin the process.

Dealing with the question of validity of the Just & Hanaman patent, counsel argued that there was no subject-matter for a patent, inasmuch as it merely took tungsten, a metal already known as suitable for the purpose, and applied to it the Welsbach process already known in connection with osmium. Such a combination was not invention within the meaning of the patent law.

Mr. Ballantyne was then examined by Mr. Terrel on processes described in the patents cited as anticipations, and in the Just and Hanaman patent, and particular attention was drawn to the difference between heating the filaments singly by passing current through them, as described in the patent, and heating them in bulk in a furnace, as done by the defendants. The Just and Hanaman process was, he said, practically similar to that of Welsbach, with tungsten substituted for osmium, and the instructions were such that a soft paste was indicated, and not a hard paste as used by the defendants. The defendants used such a small quantity of binder that the carbon played no important part in holding the filament together, and owing to this hard paste, different plant, including a hydraulic press for squirming, a calendar for more intimate mixing, and a continuous acting furnace was used. Nearly all the carbon was removed by the preliminary drying off of the volatile constituents of the binder, so that there was no true carbonising in the first furnace. Examined as to Dr. Passmore's experiments, witness denied that they proved in any way that the plaintiff's theory that the action was due to steam was correct. Again, the experiments to show that tungsten had no direct action on carbon except at very high temperatures were inconclusive owing to the form of the carbon being different. His own experiments under the conditions of the process indicated that a carbide was formed. He succeeded in making filaments, using all the gaseous atmospheres described by Welsbach, but had failed to produce them on the soft paste system, which the Just and Hanaman specification appeared to indicate.

The case was still proceeding when we went to press.

Obituary: *Killed in Action.*—The Chesterfield Corporation Electricity Works have suffered a great loss by the death of Mr. T. E. Bennett, Second Assistant Engineer, who was killed in action on Wednesday last week. Mr. Bennett, who was 33 years of age, had been with the Corporation for nearly 10 years, and together with several other members of the staff joined the 6th Notts and Derby's in November last, and proceeded to the front in February.

A 200 H.P. RAIL COACH WITH THE THOMAS TRANSMISSION

OUR readers are already familiar with the ingenious combined mechanical and electric transmission gear known as the "Thomas Transmission," which has been applied not only to petrol-engined touring cars and heavy commercial vehicles (see ELECTRICAL ENGINEERING, May 4th, 1911, p. 236), but also to rail-coaches propelled by internal combustion engines (see ELECTRICAL ENGINEERING, November 7th, 1912, p. 627). The system is such as to give almost the equivalent of a continuously variable ratio gear, with the result that the engine can be always running at its most efficient speed, and the carburettor can be set for economy rather than flexibility, so that figures of fuel consumption have been obtained markedly lower than by any other system. This fact was emphasised in the case of the road vehicles by the award of the R.A.C. "Dewar Trophy" in 1911 and the results of tests of the 160-h.p. rail coach supplied (in conjunction with Leyland Motors, Ltd.) to the South African Railways five years ago. It was the successful results with this coach that led to the New Zealand Railway authorities determining to give the system a trial, and the chassis of a 200-h.p. coach which is complete and ready for shipment

is thus locked solid with the engine, so that when the battery provided for the purpose is connected across the series machine C the engine is caused to rotate and starts up. In order to understand the action of the gearing, let it be assumed that both clutches are disengaged. When the engine drives the casing B a differential action is set up between the large sun wheel and the small sun wheel. The large sun wheel tends to rotate forwards in the same direction as the engine and the small sun wheel tends to rotate backwards in the opposite direction to the engine. If the clutch E is engaged, then the large sun wheel will be held stationary as it is connected direct to the load, and as the small sun wheel is free, it will rotate backwards at about the same speed as the engine rotates forwards. If current is taken from the machine C the motion of the small sun wheel will be retarded, so that the large sun wheel, i.e., the load, must begin to move. By manipulation of the field of the machine C this action can be continued until the small sun wheel is practically brought to rest, and the large sun wheel caused to rotate at about half engine speed. During this initial period the current from the machine C is transmitted to the motor, driving the second bogie electrically. It is clear, therefore, that there is a mechanical drive to the first bogie and an electrical drive to the second bogie. The next operation is to increase the speed of the large sun wheel gradually until it reaches the engine speed, so that the gearing can be locked solid by means of the clutch F, and a "direct" drive obtained for top speed. This speeding up of the large

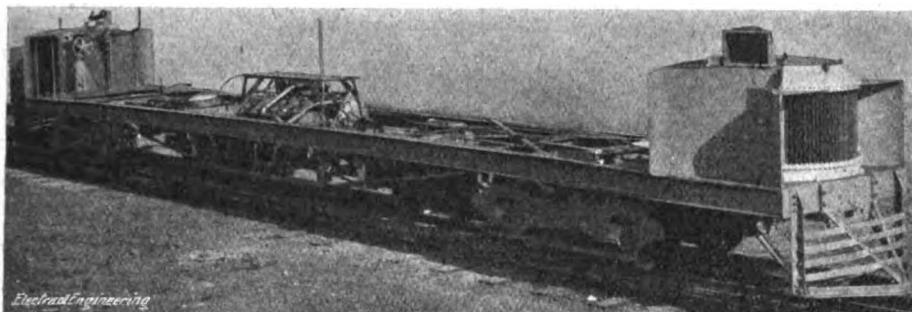


FIG. 1.—COMPLETE CHASSIS OF 200 H.P. RAIL COACH.

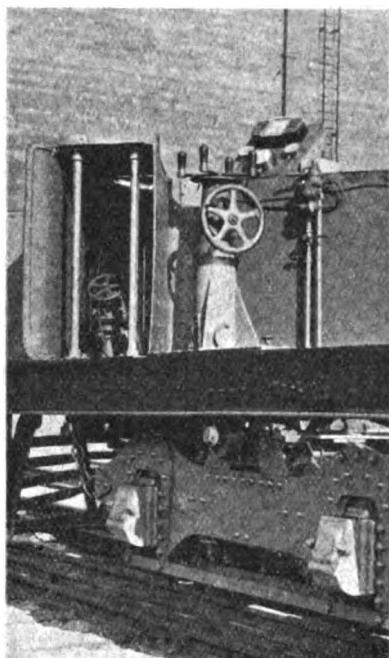


FIG. 3.—CONTROL APPARATUS.

was recently shown running to a party of engineers and Press representatives. The complete chassis is shown in Fig. 1, and further details of the control gear can be seen in Fig. 3. The coach is driven by a 200-h.p. eight-cylinder engine made by J. Tylor & Sons, Ltd., running at from 900 to 1,500 r.p.m., and situated in the centre of the vehicle. This is coupled to the electro-mechanical apparatus shown in Fig. 2, and with certain covers removed and diagrammatically in Fig. 4. This forms the first part of the Thomas transmission gear proper, and the shaft D drives one bogie through universal joints and a bevel and spur reduction gear. The other bogie is driven in circumstances detailed more fully below by an electric motor only through a similar cordon shaft, this motor taking current when in use from the dynamo C (Fig. 4).

The variable ratio drive is obtained in the following manner:—The engine shaft is permanently connected to the casing B, which carries a set of planet wheels on two spindles which are supported in roller bearings in the sides of the casing. Each spindle has rigidly fixed to it two planet wheels of different diameters, and these in turn mesh with two sun wheels. The larger sun wheel drives the shaft D through the free-wheeling magnetic clutch E. The smaller sun wheel is connected direct to the armature of the electrical machine, and a magnetic clutch F is provided for locking the planetary gearing. In order to start the engine, the clutch E is disengaged, and the clutch F engaged. The electrical machine C

sun wheel from half speed to top speed is obtained by changing the functions of the two electrical machines, and causing the motor in the other bogie to act as a generator and supply current to C as a motor, driving the latter in the same direction as the engine. This operation is a gradual one, and is carried out by manipulation of the field of the motor. When the sun wheels and the casing have reached a common speed, the magnetic clutch F is engaged, so that the electrical transmission is cut out altogether and a direct drive obtained from the engine to the first bogie.

It is important to notice that with this arrangement the adhesion of the driving wheels on both bogies is made use of during acceleration when the tractive effort is greatest, although on top speed the drive is by one bogie only. As the vehicle has to travel equally well in either direction, it is necessary to provide a reversible engine, but for shunting and reversing for very short distances an emergency reverse is provided, which works in the following manner:—The clutch E is disengaged and the clutch F engaged, so that the machine C is locked solid with the engine. Current is then taken from this machine as a generator to the machine on the other bogie acting as a motor with a reversed field, and the vehicle driven purely electrically from the second bogie in the opposite direction. The battery is quite small, being only used for starting the engine and lighting the vehicle, and is charged when the car is running on top speed and the electrical machines are not contributing to the drive.

The chief advantages claimed for the system compared with those of other electrical transmission gears are the low cost of

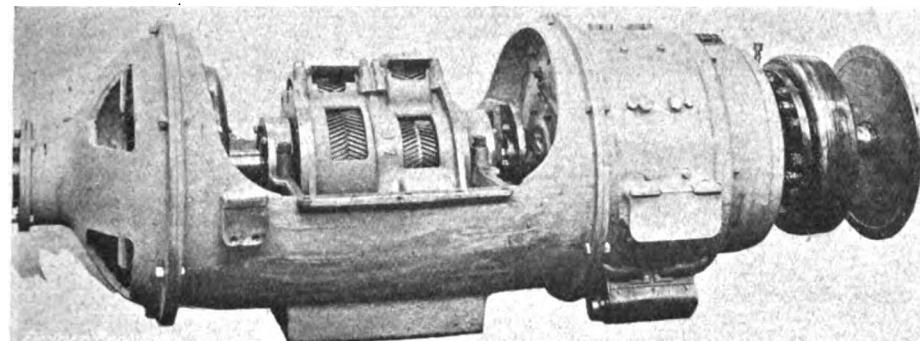


FIG. 2.—THOMAS TRANSMISSION GEAR.

the electrical equipment, high efficiency, and simplicity of control. The electrical machines only transmit a portion of the power from the engine, and are only in action when the vehicle is accelerating or climbing gradients. The result is that they can be smaller than is possible with any other system. The high efficiency obtained is due to the fact that a direct drive is provided for top speed, and on all the lower speeds most of the power is transmitted to the load direct mechanically through the large sun wheel. The control is remarkably simple as it is purely electrical, and is obtained by manipulation of the fields of the two electrical machines and the excitation of the two magnetic clutches, and as we have already remarked, a very large number of controller stops can be obtained.

This chassis will have a 50-seated body mounted thereon, and two 25-ton trailers will accommodate a further 50 pas-

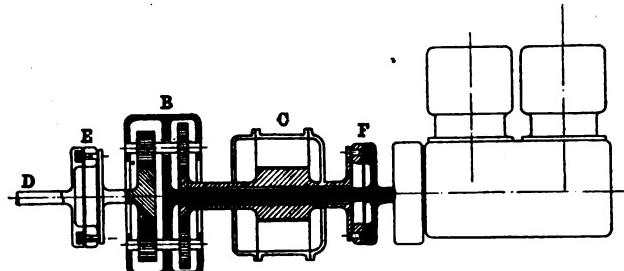


FIG. 4.—DIAGRAM SHOWING ARRANGEMENT OF TRANSMISSION GEAR.

sengers each. On the level its maximum speed will exceed 40 m.p.h., and it will haul one trailer of a 1 in 40 grade at 28 m.p.h., or both at 10 m.p.h. The fuel consumption on a give-and-take road is expected to be within one gallon per 200 ton-miles.

It will be remembered that in the road vehicles fitted with the system the second electrical machine was mounted on the equivalent of the shaft D (Fig. 4), contributing to the drive of the same wheels when in use, but otherwise the system is identical. Another use to which the system is being adapted is the propulsion of a road train. In this case the engine's first electrical machine and planetary gear is on the tractor, while the trailing vehicles are all electrically-driven to a greater or less extent on the lower speeds, but not when the top speed is attained and the direct drive is in use.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,450.

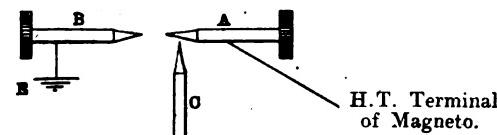
I am in charge of the electrical plant at a large works. The current is supplied to us through a 1,200-kw. 6,000-500-volt three-phase transformer, and drives a large number of induction motors. The star-point of the transformer is not earthed. I have tested all motors and feeders to earth with the megger, and I get a good test; but when I put the current on, I get a faint glow on two 220-volt lamps connected in series from all three phases to earth. I afterwards placed one 220-volt lamp across each phase to earth, but I only got the same faint glow.

I then switched the current off the transformer, and I tested the low-tension side of transformer when in circuit with ten feeders and distribution-boxes up to the motor switches. I got a test of 600,000 ohms on all phases to earth. The current was then switched on the feeders, but I still get the same faint glow on the lamps as before. The question is: Why do I get a glow on the lamps, and why only the same glow on the single lamp? If there is leakage to earth there must be a short on at least two phases through earth, but I have no fuses blown.—"PELICAN."

(Replies must be received not later than first post, Thursday, July 15th.)

ANSWERS TO No. 1,448.

It is the custom in testing magnetos to connect the high-tension terminal through a spark gap to earth, the gap being such as that shown on the accompanying diagram, the points



being lettered A and B. It is found, however, that when a further point, C, insulated from both of the others, and from earth, is introduced, as shown, the magneto sparks much more readily. What is the explanation of this?—"RADIAUM."

The first award (10s.) is given to "L. R." for the following reply:—

The action of the auxiliary discharge assister will be best understood by considering a modified form on which it is based. If a discharge is taking place between the ends of two wires connected with the poles of an induction-coil, the ends of the wires being at such a distance that the spark passes freely, then if an insulated wire be so placed that one end is near the positive terminal, and some other point on the wire is almost touching the wire leading to the positive terminal, the length of the spark is greatly increased. A wire similarly placed with regard to the negative terminal has no effect, if the condenser is properly adjusted. The ratio of the increase depends upon the shape of the terminals, but the actual length of the spark tends towards a maximum almost independent of the shape of the ends. Also, if an insulated wire be placed at right angles to the negative wire, near its terminal, the length of the spark is similarly increased—to some extent if touching the negative wire, to a greater extent if almost touching. This is the arrangement referred to. It is, of course, incidental that a magneto is used instead of an induction coil, the same results being obtained on the corresponding half waves.

The explanation is probably that the action of the negative assist is due to the attraction of the negative electrons in the assist and discharged from the assist on the positive electrons. When the negative assist is impulsively charged across its spark-gap this causes an induced impulsive rush in the positive wire, causing the positive electrons to leave the terminal with greater velocity. The effect on the negative assist is probably added to by a discharge of negative electrons from its point when it is impulsively charged. This negative discharge from the point is in an effective position to act attractively upon the positive electrons, and endures long enough to produce its full effect. When the negative assist is surrounded by an insulator, or when a sheet of vulcanite is brought up close to its point, the negative discharge is either entirely prevented or is quickly re-absorbed.

This matter is discussed at some length in a Paper by T. J. Bowlder in the *Philosophical Magazine*, Vol. 8, p. 487, 1904, and details of the variations of the spark length under certain conditions are given therein. The phenomenon has also been employed by Williams in the spark-gaps for Hertzian transmitters and the like, and he explains it on the ground that the assisting electrode forms a circuitous shunt for the discharge of a small fractional part of the whole of the electric energy, very minute sparking being maintained between the assisting electrode and the adjacent electrode, the stem of the assist serving to collect the distributed invisible discharges between itself and the remote electrode. He leads up to this by first taking the case of an assist which bridges across the gap, but does not touch either electrode, gradually coming to the form in which the assist is at right angles to the path of the spark, one end being close to one electrode (see British Patent No. 175 of 1903). Williams also proposes to use the device for ensuring the ignition sparks in internal combustion engines.

The second award (5s.) is made to "P. R. C." who writes as follows:—

The phenomenon described by "Radium" is one that is not confined to the testing of magnetos, as it is apparently merely a variation of the discovery originally made by Hertz as long ago as 1887 that the impact of ultra-violet light upon a spark-

gap which is on the point of breakdown has a stimulating action upon it, and facilitates the passage of the spark discharge. In the case described very minute sparks would pass to the insulated side point, and these being so close would easily influence the main spark, and cause the discharge to pass more readily. The use of a point for the side electrode would facilitate the passage of these side sparks more than would be the case if a knob were used. In addition to the above, a slight action would in all probability be due to the close proximity of the side sparks causing the main spark-gap to become slightly

ionised. This would again facilitate the passage of the main discharge.

Question No. 1,446.—A correspondent has pointed out an error in the diagrams in Figs. 1 and 2 in the published answers to the question on p. 280 of our issue of June 24th. The letters *A* and *L+* on the starter terminals should be interchanged so that the positive line connection is brought to the starter arm and armature terminal to the last resistance stop. This brings the connections in line with those in Fig. 3.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 1st, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

18,357/13 and 19,732/13. **Precipitation of Dust, Smoke, &c.** E. MÖLLER. Methods of separating suspended solid particles from gases by the presence of charged electrodes. In the first method a grid is used of alternating ionising electrodes in the form of rods, with saw-like toothed edges, and non-ionising electrodes of strip form. In the second, the gases are passed through parallel cylindrical tubes with a high-tension electrode in the form of a wire down its centre. (Four figures and two figures.)

6,341/14. **Meters.** SIEMENS-SCHUCKERT WERKE G.M.B.H. Induction meters maintaining the straight line relation between the load and the speed of the armature at light loads by shunting a variable proportion of the lines of force generated in the field coils by suitably dimensioned magnetic masses which begin to be saturated before the higher values of the load are reached, and are placed so as to deflect the lines of force from the armature. (Two figures.)

8,684/14. **Incandescent Lamps.** ELECTRIC UTILITY Co. and R. W. LONG. A device for winding filaments of incandescent lamps, comprising a block or thimble adapted to be mounted temporarily on the stem of the lamp, and carrying stout wires or like supports so situated that when the block or thimble is in place, there is a wire or support in such relationship to each of the flexible hooks on the stem of the lamp that the filament can be wound on a horizontal portion of the wire or support, and afterwards slipped therefrom into the hook. (Two figures.)

14,030/14. **Transformers.** F. E. BERRY. Improvements in transformers of the class in which laminated iron strips are placed between the primary and secondary windings to provide a shunt path for the leakage flux in cases where high reactance is desired. According to this invention the shunt path is constituted by a series of laminated iron strips arranged in groups separated by air gaps, the air-gap separation proceeding in a direction axial on both circumferential and axial to the transformer windings. (Three figures.)

14,415/14. **Variable Speed Motors.** H. H. JEFFCOAT. Means for varying the speed of A.C. motors, consisting in a combination of a commutator connected directly to the windings of the stator or rotor or commutator, connected to both, and brushes capable of rotation driven by a variable speed or other mechanism. (Two figures.)

20,549/14. **Cables.** C. J. BEAVOR and E. A. CLAREMONT. A high-tension cable designed to increase the cross section of the conductor so as to minimise stress on the insulation without using more copper than is necessary for conduction. The conductor is composed of a hollow metal core with metal strands stranded or braided thereon, and a metal tube forming the outside of the metal strands. The core and tube may be of lead or other suitable pliable metal, and the metal strands of copper. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: BRESLAUER [Alternators] 19,445/13; KLEINER [Motors for shaking shoots] 20,776/13; BRITISH WESTINGHOUSE Co. [Dynamos] 4,560/15.

Heating and Cooking: BERRY [Heaters] 14,469/14.

Ignition: HEINS and WILD [Ignition system] 6,992/14.

Instruments and Meters: A.E.G. [Coil bobbin for instruments] 21,959/13.

Switchgear, Fuses, and Fittings: A.E.G. [Oil switchgear, &c.] 23,348/13; B.T.-H. Co. (A.E.G.) [Regulators] 7,007/14;

WINEBERG and PARKER [Conduit continuity device] 14,163/14; MANSON [Conduit fittings] 14,392/14; ELLISON [Circuit-breakers] 16,984/14; DICKINSON and OPTALYTE, LTD. [Hand lamp] 19,679/14; HEMMING and BECK [Conduit fittings] 19,908/14; B.T.-H. Co. (A.E.G. Co., U.S.A.) [Rheostats] 19,943/14 and 20,129/14; R. BOSCH [Electromagnetic switch] 20,927/14; SCLATER [Conduit fittings] 24,742/14.

Telephony and Telegraphy: SIEMENS & HALSKE A.G. [Automatic telephones] 23,336/13; STILLE [Telegraph or telephone relay] 7,200/14; [Electric transmission of sound] 7,202/14 and [Microphones] 7,203/14; SIEMENS BROS. & CO. and PETTITHORPE [Automatic telephones] 7,208/14; SIEMENS & HALSKE A.G. [Semi-automatic telephones] 7,327/14; SCHIESSLER [Wireless telegraphy and telephony] 11,708/14; BURFEIND [Telephone systems] 14,808/14; GREEN [Telephone switches] 15,125/14; SCHNEIDER and STOLZ [Telephones] 19,538/14.

Traction: NUSSER and MILES [Signalling] 20,824/13; MIDGLEY and VANDERVELL [Engine starters] 21,782/14.

Miscellaneous: B.T.-H. Co. (A.E.G.) [Mercury-vapour rectifiers] 21,574/13; ZEHDEN [Burglar alarms] 7,266/14; HEIMROD [Mercury-vapour rectifiers] 13,973/16; SIEMENS SCHUCKERT-WERKE GES. [Electrically-driven drilling machine] 14,021/14; EHRLHART [Condensers] 14,793/14; GREEN and LANDON [Mining signals] 20,342/14; PORDES [Batteries] 1,530/15; MARSHALL [Air heaters for thermopiles] 7,283/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Telegraphy: AGNER [Wireless telegraphy] 6,217/15.

Traction: R. BOSCH [Engine starters] 20,928/14, and [Car lighting] 5,184/15.

Miscellaneous: Soc. ANON. DES ETABLISSEMENTS L. BLÉRIOT [Electromagnetic make-and-break device] 8,770/15.

Petition for Restoration of Lapsed Patent

10,675/10. **Reinforced Concrete Telegraph Posts.** R. ESPAZA. A petition has been lodged for the restoration of this patent, which had been allowed to lapse owing to non-payment of renewal fees. The specification describes a method of constructing hollow concrete telegraph posts on a reinforcing framework of upright rods and helical wires.

Opposition to Grant of Patent

22,435/14. **Electromagnetic Switches.** T. E. BARNUM and W. E. DATE. Opposition has been entered to a grant on this application. The specification describes electromagnetic switches or contactors of the lock-out type controlled by separate and opposing electromagnets energised by a common current, which, if it does not exceed a predetermined value, operates to close the switch; but, if it does exceed that value, prevents the closing of the switch.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: A. D. JONES [Enclosed flame arc lamps] 5,829/08.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: J. LUNDGREN [Braiding machines] 6,646/02; J. STRATTON and E. A. CLAREMONT [Cables] 6,151/09.

DYNAMOS, MOTORS AND TRANSFORMERS: A. J. BOULT [Testing insulation of wire while winding field coils] 6,099/06; L. J. HUNT and SANDYCROFT FOUNDRY Co. [Cascade windings] 6,223/06; G. WESTINGHOUSE [Ventilation of turbo-generators] 6,118/07; B. T.-H. Co. (G.E. Co., U.S.A.) [Compensating windings] 6,649/07; [Motor control] 6,564/09; and [Motor speed indicator] 6,673/09.

Instruments and Meters: D. COX [Resistance measurement by electrometer] 6,193/02.

Switchgear, Fuses and Fittings: B.T.-H. Co. (G.E. Co., U.S.A.) [Contactor controllers] 6,528/07.

Miscellaneous: D. K. MORRIS and G. A. LISTER [Long stroke magnets] 6,083/07; MAVOR & COULSON, S. M. and H. A. MAVOR [Coal cutters] 6,051/09.

"ELECTRICAL ENGINEERING" TRADE SECTION

NEW SIZES AND PRICE REDUCTIONS IN HALF-WATT LAMPS

SEVERAL firms have sent us lists and particulars of the new sizes in half-watt lamps, and have also reduced the price of some of the sizes hitherto on the market.

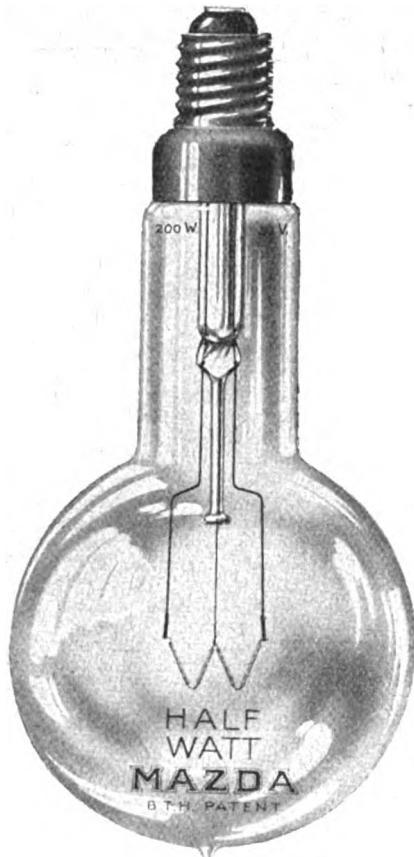


FIG. 2.—200-WATT LAMP.

It will be useful to give a complete list of the sizes of these lamps now obtainable. Those in italics are new sizes:—

25 volts:—15, 30, 60, and 100 watts. All bayonet caps. Prices from 4s. 6d. to 12s. 6d.

FIGS. 1 & 1A.—100-WATT MAZDA LAMP AND SKETCHES SHOWING SHAPE OF FILAMENT.

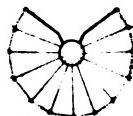


FIG. 1.—100-WATT MAZDA LAMP AND SKETCHES SHOWING SHAPE OF FILAMENT.

Bayonet caps for the 100 watts, Edison screw caps for the 150 and 200 watts, and Goliath screw caps for the remainder. Prices from 12s. 6d. to 50s.

FIG. 3.—SPECIAL PROJECTOR LAMP.

Mazda Half-Watt Lamps.

The British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), issues its list in the form of an attractively got-up catalogue containing general particulars with regard to the lamps and their scope, and some illustrations showing effective lighting by half-watt lamps. We reproduce three illustrations of the lamps themselves: Figs. 1 and 1A show the 100-watt size with a plan underneath showing the shape of the filament; Fig. 2 is a 200-watt lamp; and Fig. 3 is a special projector lamp with grid filament in a vertical plane and one side of the bulb silvered. At present the latter lamp is only obtainable for 100-130 volts, and in sizes from 300 to 1,500 watts.

Royal Ediswan Half-Watt Lamps.

The Edison list (The Edison & Swan United Electric Light Co., Ltd., Ponders End, and 123-5 Queen Victoria Street, E.C.) includes an excellent picture, which we reproduce (Fig. 4), of the 100-watt lamp, showing clearly the shape of the filament. The list is in the form of a four-page sheet, which is well arranged and practically confines itself to the essential details of sizes, &c.

Wotan Half-Watt Lamps.

Like everything published by the Lamps Department of Siemens Bros. Dynamo Works, Ltd. (38 and 39 Upper Thames Street, E.C.), their new catalogue of Wotan half-watt lamps is distinctive. Besides complete technical and business details, they include in it pictures of stage, railway station, and bank lighting.

Osram "Atmos" Type Lamps.

"Atmos" is the name now given by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), to the Osram half-watt lamp. The voltages and wattages and caps are those already mentioned, but the distinctive feature of the leaflet issued by

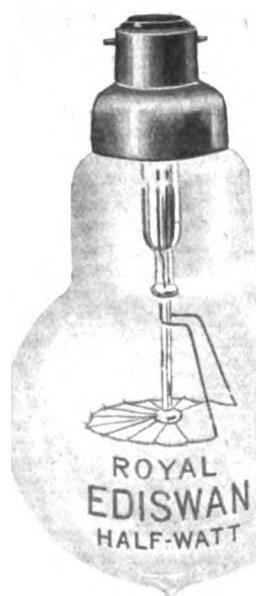


FIG. 4.—100-WATT LAMP.

50-65 volts:—30, 60, 100, 150, 200, 300, and 500 watts. Bayonet caps from 30 to 100 watts, Edison screw caps for 150

this maker is that it is stated that the lamps are made at Hammersmith.

Drake & Gorham Lamps.

Messrs. Drake & Gorham, Ltd. (1 Felix Street, Westminster, S.W.), have printed their list of half-watt lamps in three different forms, destined for practical use. One is in the form of a letter to the contractor, another is a hanging card of convenient size and shape, and the third is a neat pocket folding leaflet for the pocket book, giving, in addition to the list, a few "selling points" briefly and tersely put. Lamps of new sizes and prices are conveniently indicated by red type.

Other matter with regard to the new half-watt lamps will be found in an article on p. 294.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Melbourne City Council requires 1,381 meters and 75 maximum demand indicators. Tenders by July 27th to McIlwraith, McEacharn & Co., Biliter Square Buildings, London, E.C.

Barking.—In reference to the Council's application for a loan of £18,000 the L.G.B. has sanctioned £1,376 for mains and services and £117 in respect of an alternator and transformers. As regards the remainder, the decision of the Board is deferred until revised estimates have been prepared.

Bristol.—A L.G.B. inquiry was held last week concerning a loan of £27,295 for the purposes of the electricity undertaking. Of this amount a 6,000-kw. turbo-alternator, &c., represents £26,949, and the balance is for excess of expenditure over existing loans. The Inspector was informed that the estimated extra demand of 2,174 kw. added to the present load of 4,947 kw. would leave a margin of only 2,715 kw., or rather less than the full capacity of one of the largest units of plant, viz., 3,000 kw. This, it is felt, is an insufficient margin, and hence the desire to instal a new generating set. The Bristol Ratepayers' Association opposed the loan on the ground that there is no real need for it at present. The offer was made to the Corporation to call in an independent electrical engineer to value the existing plant, the argument being that if it is all in good condition the new plant is not required. This inspection the Ratepayers' Association offered to pay for. In reply it was stated that the Corporation feels the need of being in a position to supply as much current as possible for the large amount of munitions which are being made in the district.

Hull.—Machinery oils for electricity works and sub-stations. Acting City Electrical Engineer. July 22nd.

Manchester.—Street electric lighting extensions in Oldham Street.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Manchester.—Shop property and commercial premises. Architect, J. B. Thorley.

Wednesbury.—Extensions to municipal offices, public baths, and new education offices.

Miscellaneous

Australia.—The Victorian Railway Commissioners, Spencer Street, Melbourne, require 20 miles of vulcanised rubber electric light cable. Further particulars at 73 Basinghall Street, E.C.—The Deputy Postmaster-General, Adelaide, requires magneto bells, trembling bells, switchboard cable, and lead-covered paper-insulated cable. British firms may consult specification at 73 Basinghall Street, E.C.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Winchester.—Messrs. Ferranti, Ltd., have received a contract for twelve months' supply of prepayment meters.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. Shepherd has now taken over the Consulting Engineering practice of Shepherd & Watney (32-34 Greek Street Chambers, Leeds), and hopes to make the inspection of plant a particular feature of his future work, in addition to the other activities of the firm. Mr. Watney will continue his interest in the practice in an advisory capacity. Mr. Shepherd has left the L.C.C. tramways after 13 years' service with them; for eight years he was Chief Assistant Electrical Engineer, and since 1910 has had entire charge of the electrical work of that undertaking. During the previous fifteen years he had held responsible positions with leading manufacturing companies.

A switchboard attendant is required in the Leek Electricity Department. Salary 30s. per week.

The Birmingham Corporation Electricity Department requires sub-station attendants. (See advertisement on another page.)

A switchboard attendant is required by the Mexborough & Swinton Tramways Co. (See advertisement on another page.)

Engine-drivers and electric light attendants are required at the Aghada Camp, County Cork. Applications in writing to the Officer Commanding R.E., at the Camp.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Sons, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £93 to £94. (Last week, £94 10s. to £95 10s.)

Australian Agencies.—A firm in Queensland desires to represent British manufacturers of electric lamps. A Melbourne firm desires to represent British manufacturers of electrical goods. Further particulars at 73 Basinghall Street, E.C.

Companies Struck Off Register.—The names of the following will be struck off the Register of Joint Stock Companies in three months' time unless cause is shown to the contrary: British Automatic Telephone Syndicate; Consolidated Electric Works & Appliances; "Electricity," Ltd.; Haywards Heath Electric Supply Co.; Pacific Radiotelegraph Co.; Premier Electric Control; Radio & Electric Power Co.; Tramways Construction Syndicate; Tungsten Metal Co.; United Electrical Construction Syndicate.

"Westool" Electric Tools.—The Westminster Tool and Electric Co., of Suffolk House, Laurence Pountney Hill, Cannon Street, London, E.C., inform us that they have discontinued the use of the name "Vulcan" in connection with their electric tools. In future these portable electric drills, blowers, and lifting magnets will be known by the registered trademark "Westool."

"Thermoid" Flexible.—In the discussion at the Point Five's meeting on June 17th, Mr. A. S. Blackman (Chief Electrical Engineer, Sunderland), referred to a new type of flexible wire which he had found particularly satisfactory for electric irons and other heating apparatus. This is known as Thermoid flexible, and is made by W. T. Henley's Telegraph Works Co., Ltd. It is constructed with a special heat-resisting insulation, and with a flame-resisting external covering. It is designed to combine flexibility with strength, and not to kink. From samples which the firm have kindly sent us we find that cotton is used between a special rubber compound and the copper in the 4-ampere size the tinned copper is stranded as three strands of 7-strand wire, and in the 10-ampere size as seven strands of 7-strand wire. The outer braiding is impregnated effectively with a flame-proof composition, and the wire should combine strength with sufficient flexibility, which is the desideratum for electric irons and heating and cooking apparatus generally.



LOCAL NOTES

Eastbourne: *Electricity Accounts.*—Whilst there was a slight reduction in the revenue from private lighting last year, that from power increased almost sufficiently to counterbalance this loss. There was also an increase in the consumption for heating, but a slight decrease in that for cooking, but it is anticipated that during the coming year this latter will increase, as two large cooking outfits were being installed.

Edinburgh: *War and the Electricity Department.*—Mr. F. A. Newington, the City Electrical Engineer, has reported that it will be impossible for him to release any further members of his staff, having regard to the needs of the Department. So far as new works were concerned, the laying of new mains might be delayed, but he did not think it advisable to refuse to connect new consumers, having in mind the check this would have upon the development of the undertaking. The Corporation is well forward with the arrangements for supplying a number of parishes outside the existing limits, and here again Mr. Newington does not think it advisable to reduce the number of men employed on the mains to any extent during the next three or four months.

Exeter: *Electricity Profits.*—The net profit of £1,554 upon the electricity undertaking is to be carried forward rather than any proportion of it being transferred to relief of rates. The object of this is that the Committee hopes by this means to be able to carry through the current year without an increase in the price of current, notwithstanding the heavy extra expenditure which will undoubtedly be incurred.

Middlesbrough: *Electricity Profits.*—The gross profits on the electricity undertaking last year were £11,000 compared with £11,741 in the previous twelve months. Out of the net profit a sum of £2,000 has been allocated for the relief of rates. Thirty per cent. of the regular staff of the Department have joined the forces.

Leeds: *Large Increase in Sales.*—The report of the electricity undertaking for the year to March 31st shows, unlike so many other towns during the past year, an unprecedentedly large increase in sales to private lighting consumers, the number of units sold being 11 per cent. greater than in the preceding year, and the income 10 per cent. greater. An interesting effect, however, of the use of metal filament lamps is that the income from this source is now £3,065 smaller than it was in 1907-8, although the number of lighting consumers has grown from 5,504 to 10,759. The necessity for restricting expenditure upon services has kept off the mains a number of consumers desirous of coming on. What is called a tariff for "residential bulk supplies" has been fixed, but this is none other than the rateable value system with a charge of $\frac{1}{d}$. per unit. The net profit for the year was £24,224, but owing to the large amount invested in permanent works out of the year's profits, viz., £12,053, the amount allocated to relief of rates is reduced from £14,315 in the previous year to £12,171.

London: St. Pancras: *Increased Charges.*—The electric lighting charges are to be increased by 10 per cent.

Lytham: *Bulk Supply.*—It is possible that arrangements will be come to for taking a supply in bulk from the St. Anne's Council. A preliminary agreement has been made for entering into a contract for ten years.

Nottingham: *Increase in Charges.*—A 12 $\frac{1}{2}$ per cent. increase in the present charges for electricity is to be made in consequence of the advance in the price of coal, &c.

Oldham: *Electricity Accounts.*—There was a net profit of £3,550 on the working of the electricity undertaking last year. The total number of units sold increased by 927,058, or 13·13 per cent. In connection with the scheme of extensions which was sanctioned by the L.G.B. in December, tenders have been accepted for the supply of two 3,000 kw. British Westinghouse turbogenerators, three B. & W. water-tube boilers, two water-cooling towers, extensions to the Ferranti E.H.T. switchboard, and a new battery house and battery.

Redditch: *Electricity Accounts.*—In presenting the accounts of the Electricity Department for the past year, which show a loss of £2,508, the Chairman of the Committee pointed out that although there has been an average loss of £2,662 per year during the past three years, the actual position of the undertaking has materially improved. He also drew attention to the fact that a sum of £3,000 had been spent out of revenue on works of a capital nature.

Stoke-on-Trent: *Improved Electricity Position.*—The electricity accounts for the past year show that the net loss of

£6,162 in 1913-14 has been turned into a profit of £71. There is an accumulated deficit of £6,819 standing in the accounts of the Department. The very substantial progress which the undertaking has made is due to the re-arrangement in conjunction with the new power station which has been carried out under Mr. Yeaman's direction. Last year 10 $\frac{1}{2}$ million units were generated, compared with 9 million units in the previous twelve months, yet the coal bill was less by £2,800.

Walsall: *Electricity Accounts.*—The net profit for the year was £1,385. The question of increasing the charge to consumers is under consideration, having regard to the general increase in working costs due to coal, &c. Much depends upon whether the new power station is completed in time for the coming winter. So great has been the delay with the new power station that the Borough Electrical Engineer declines to take responsibility for dealing with the load next winter should the new plant not be available, and the Committee has been faced with the suggestion of purchasing plant for the existing works at a cost of £1,000 to deal with the winter load. This, however, the Committee is not prepared to do, and it prefers to trust to there being no accident, in which case it is believed the winter demand can be met.

Worcester: *Maintenance out of Revenue.*—In reporting a slight decrease in the revenue last year compared with the previous twelve months, and a net profit of £961 after meeting capital charges, Mr. C. M. Shaw, the Borough Electrical Engineer, points out that the policy of effecting improvements and works of a capital nature out of revenue renders it practically impossible to show large net profits. He also reminds the Council that the value of this policy is now demonstrating itself, as had it not been adopted the position of the undertaking would have been serious at the present time owing to the increased cost of labour, fuel, and other materials.

COMPANIES' DIVIDENDS, REPORTS,
MEETINGS, &c.

Crompton & Co.—The report for the year to March 31st, 1915, shows a net profit of £28,649. The sum of £6,500 is to be placed to reserve, £3,500 to special depreciation account, £1,608 is written off preliminary expenses, and after meeting the full dividend on the 7 per cent. preference shares, a balance of £7,691 is carried forward. The Company's works continue to be fully employed, a large amount of Government work being done.

General Electric Co.—In spite of the war, the total income for 1914-15 was £164,877, against £157,893 in the previous year. After setting aside £18,855 for depreciation, and £8,000 for debenture interest, a net profit of £138,022 remains. The preference dividend absorbs £38,681, and a dividend on the ordinary shares at the rate of 10 per cent. per annum is recommended the same as for the previous twelve months. Reserve is credited with £20,000, and after meeting sundry other items a balance of £36,701 is carried forward. The cable business which the company has started in conjunction with Messrs. Pirelli, of Milan, is progressing, the works at Southampton having been completed during the year. Considerable work is naturally being done for the Government, but the report points out that although the great majority of the company's products are essential for war purposes, the outlook for the year is one of some uncertainty. Nevertheless, the company, from a perusal of the accounts, is in a strong financial position to meet any troublesome period that may come along.

Edmundsons' Electricity Corporation.—After meeting the dividend on the preference shares, the profits last year permit of £10,000 being transferred to reserve, and £3,365 carried forward.

Manufacture of Cables in Norway.—The *Anglo-Norwegian Trade Journal* states that before the war, Germany exported almost all sorts of electric cables and wires to Norway. The import was free of duty for the finished goods, while Norwegian factories in this branch had to pay duty up to 10 per cent. of the value for raw materials. There were, therefore, no possibilities for a Norwegian industry until the war stopped all export of German cables, and the Norwegian factories got an opportunity which they at once seized. In Drammen there is a factory for copper wire, "Elektrisk Industri," and a cable factory "Norsk Kabelfabrik," while in Christiania there are the cable factories "Elektrisk Bureau" and "Norsk Elektrisk Kabelfabrik."

Glover's Almanac.—There are not only many items of useful technical information, but also many sparks of wit expressed in literary and pictorial form in the well-known daily tear-off almanac now issued by W. T. Glover & Co., Ltd., for the fourteenth time, and covering the period from June, 1915, to June, 1916, a time fateful in the destiny of nations.

ELECTRICAL ENGINEERING

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(Established 1884)

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SUMMARY

THE fourth list of members of the Institution of Electrical Engineers on active service brings the total up to 1,083 (p. 302).

SOME notes on the forthcoming sessions of technical colleges, etc., are given (p. 302).

SOME descriptive particulars are given of the two 1000 kw. Ljungström turbo-alternators recently installed at the Luton Electricity works (p. 303).

THE hearing of the patent action between Osram Lamp Works, Ltd., and Pope's Electric Lamp Co. was concluded on Tuesday. Judgment was reserved (p. 304).

A PROBLEM on the regulation of a plating dynamo is propounded in our Questions and Answers column (p. 304).

AMONG the subjects of specifications published at the Patent Office on Thursday, were high frequency alternators, voltage regulators, telephone relays and conduit joints. Application has been made to suspend certain patents relating to meters. Two patents relating to electric furnaces expire this week after a full life of fourteen years (p. 305).

THE estimated loss on the L.C.C. tramways for 1915-16 is £91,614 (p. 306).

CONSIDERABLE difficulty is being experienced in maintaining direct wireless communication between Germany and America (p. 306).

NEW ironclad switchgear and examples of street lighting by half-watt lamps are illustrated in our Trade Section (p. 307).

A LOAN of £20,000 is to be taken up for mains at

Bradford; cable, cable accessories and transformers are required at Dublin; electrical stores at Edinburgh and generating plant at Halifax and Erith (p. 307).

THE Manchester electricity undertaking showed a satisfactory profit last year notwithstanding the war.—The municipal wiring powers recently granted to Plymouth by a House of Lords Committee have been modified by the Lord Chairman of Committees, who has substituted the old "model" clause stipulating that work shall be done through a contractor (p. 308).

AT the annual meeting of the General Electric Co. last week reference was made to the large amount of Government work which the Company was carrying on.—No interim dividend is to be paid at present on the ordinary shares of the Newcastle-on-Tyne Electric Supply Co. (p. 308).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING JULY 24TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday:—6.30 and 7.30.—No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill without arms.

No. 4 Squad, Squad Drill with arms.

Wednesday:—6.30 and 7.30.—Platoon and Company Drill.

Friday:—6.30 and 7.30.—No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill with arms.

No. 4 Squad, Squad Drill without arms.

Orderly Sergeant:—R. W. T. Corbett.

Recruit Orderlies:—Squad 3, S. V. Spiers; Squad 4, J. Foxton.

Munition Work:—Owing to shortage of material, it has been impossible to arrange work for Saturday, July 17th.

Camp at Thames Ditton:—The Architects will welcome any member of the E.I.V.T.C. who wishes to spend the week-end in camp. Names must be given to the undersigned by Wednesday morning, and members going to camp must take with them blankets, knife, fork, spoon, cup, and soup plate: expenses about 7s. 6d.

Punctuality on Parade:—Owing to the amount of time lost on falling-in on parade, members are reminded that drills commence at 6.30 and 7.30, and every man must be in position when the fall-in is sounded. Any member who is not present when his name is called will not count a drill for the hour for which he is late.

E. G. FLEMING.

(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W.

The Electrical Market in China.—H.M. Consul at Shanghai (says the *Board of Trade Journal*) reports that the importation of machinery and the installation of electric lighting apparatus in China is worthy of the closest study by British firms. Last year the Shanghai municipality supplied over 40 million units, compared with 21 million units in the previous twelve months, and no less than 1,500 radiators have been installed in Chinese houses. British installations have recently been completed for a number of large cities in China, but hitherto the business has been largely in the hands of Germans, mainly because they have been willing to undertake entire contracts and to finance them.

ELECTRICAL MEN ON MILITARY SERVICE

THE fourth list of members of the Institution of Electrical Engineers on military service has just been issued, and includes 228 names, bringing the total to 1,033. The first list was published in our issue of Jan. 21st, the second list on Feb. 18th, and the third list on March 4th. We give the fourth list in full below:—

MEMBERS.

R. L. Alkin (2nd Lieut.); Brig.-Gen. W. B. Brown (R.E.); J. H. Butters (Capt. Australian Engineers); L. E. Caine (Director British East African Field Telegraphs); W. S. Carr (Lieut. R.G.A.); W. L. Carter (Capt. Hong-Kong Volunteer Reserves); C. L. Cartwright (Lieut. Madras Volunteer Guards); J. K. Catterson-Smith (Lieut. R.N.V.R.); J. Clarke (Lieut. Nauru Volunteer Reserve); Major C. G. G. Crawley (R.M.); H. Dawson (Hon. Major Australian Engineer and Railway Staff Corps); G. H. J. Hooghwinkel (Capt. R.F.A.); Major J. N. C. Kennedy (R.E.); H. S. King (Sergeant New Zealand Field Engineers); Lt.-Col. E. H. Leaf (R.E.); Lt.-Col. H. M. Leaf (R.E.); G. McAlpine (Lieut. R.N.V.R.); J. M. S. Maxwell (Capt. R.E.); T. H. Minshall (Major R.E.); J. S. Pringle (2nd Lieut.); F. J. Robins (Lieut. 1st Calcutta Volunteer Rifles); W. A. Vignoles (Major).

ASSOCIATE MEMBERS.

C. E. Abell (2nd Lieut.); J. O. Archer; J. G. Balsillie (Chief Radio Censor, Melbourne); Capt. J. S. Barker (R.E.); W. F. B. Bartram (Lieut. R.M.); T. O. H. Bates (2nd Lieut. Indian Army); H. L. Bazalgette (Lieut. R.E.); R. G. Beer (2nd Lieut. R.E.); H. B. Bennett (2nd Lieut. Indian Army); P. R. Blake (A.B. Anti-Aircraft Corps); R. W. H. M. Bland (Lieut.); E. G. Boissier (Sub-Lieut. R.N.D.); F. H. Brandreth (2nd Lieut.); C. A. Brearley (Sapper Divisional Engineers, R.N.D.); A. W. Brown (2nd Lieut.); M. A. Bulloch (Lieut. A.O.C.); K. D. Bullpitt; Capt. E. D. Carden (R.E.); J. H. Cardew (2nd Lieut. R.F.A.); W. J. I. Casewell (Divisional Engineers, R.N.D.); P. J. Clears; J. Coghlan (Australian Field Engineers); Major S. H. Cowan (R.E.); F. G. Cresswell (Engr.-Lieut. R.A.N.); A. E. H. Dinham-Peren (Lieut. South African Engineer Corps); W. E. Downey (Lieut. A.O.C.); P. Dunsheath (2nd Lieut. R.E.); G. B. Dyke (2nd Lieut. R.G.A.); E. A. Edwards (2nd Lieut. R.E.); A. W. Empson (Mechanic Motor Machine Gun Service); C. T. Eriksson (Lieut. Rhodesia Reserve Volunteers); Major L. Evans (R.E.); C. L. Faunthorpe (2nd Lieut.); P. L. R. Fraser (Lieut. R.N.V.R.); Hon. E. Fulke French (Divisional Engineers, R.N.D.); M. R. Gardner (A.B. Anti-Aircraft Corps); F. J. Gellion (Hong-Kong Volunteer Reserves); J. W. Gibson (A.B. Anti-Aircraft Corps); S. C. Gibson (Lieut.-Comm. R.N.V.R.); V. W. Gill (Divisional Engineers, R.N.D.); H. Gray (Capt. R.F.A.); J. W. Griggs (Divisional Engineers, R.N.D.); W. Harling (Lieut. R.E.); E. J. Harper (Divisional Engineers, R.N.D.); R. A. Harris (2nd Lieut. R.E.); J. R. Henry (South African Burgher Commando); W. J. Henry (Sub-Lieut. R.N.D.); W. Hockley (Squad-Comm. Vancouver Engineer Reserves); F. R. Hoggett; G. A. Hollings (Bombay Volunteer Rifles); Stratton Holmes (Lieut. R.N.V.R.); W. Holmes; F. H. Horner (2nd Lieut. R.E.); B. Hoyle (R.E.); A. H. Huddart (Lieut. A.S.C.); D. G. Hurllab (Bombay Volunteer Rifles); P. S. E. Jackson (Madras Artillery Volunteers); J. G. Jones; Major G. S. Knox (R.E.); P. B. Lawson (Director of Posts and Telegraphs, Cameroons); R. F. Long (Hong-Kong Volunteers); R. T. McArthur (Capt. South African Field Telegraph Corps); C. R. McGowan (Lieut. R.E.); Capt. C. H. Malden (R.M.L.I.); T. S. L. Mann (Westminster Dragoons Yeomanry); G. E. Marley (Hong-Kong Volunteer Reserves); H. F. Mason (Lieut. R.G.A.); T. H. Matthewman (Hong-Kong Volunteer Reserves); W. J. Mitchell (Lieut. N.Z.G.A.); S. M. Mohr (2nd Lieut.); A. R. Newman (R.N.); J. O. Nichol (Lieut. R.N.V.R.); C. H. Noyce (Divisional Engineers, R.N.D.); H. Ogilvie (Canadian Force); G. Paton (2nd Lieut.); F. G. Payne (Lieut.); J. V. Payne (Driver A.S.C.); A. Podmore (2nd Lieut. R.E.); B. Pontet (Bihar Light Horse Reserve); A. R. Z. Porter (Lieut.); T. Y. Porter (2nd Lieut. A.S.C.); T. F. Potts (Staff-Sergeant, R.E.); H. H. L. Prendergast (2nd Lieut. Railway Transport Dept.); E. B. C. Preston (2nd Lieut. 32nd Sikh Pioneers); A. R. Price (2nd Lieut. Reserve of Officers, Indian Army); Capt. W. C. H. Prichard (R.E.); J. D. K. Restler (Sub-Lieut. R.N.D.); Major G. B. Roberts (R.E.); A. M. Robertson (2nd Lieut. R.E.); Comm. E. G. Robinson (R.N.); C. G. Seeley; R. C. Simpson (Lieut.-Col. Australian Militia); D. H. Slack (2nd Lieut. R.E.); Prof. C. A. M. Smith (Hong-Kong Volunteer Reserves); F. Smith (Calcutta Scottish Volunteers); T. V. Smith (2nd Lieut. Royal Flying Corps); W. H. Smith (Capt. R.E.); V. Sorby (Chief Petty Officer R.N.); R. E. Staco (Capt. R.E.); H. A. Starkey (Lieut. Calcutta Naval Volunteers); W. D. Stewart; C. Stafford (Hong-Kong Volunteer Reserves); J. H. Thomas (2nd Lieut. R.E.); F. E. Tilley (Divisional Engineers, R.N.D.); C. G. Trevett (Lieut. South African Engineer Corps); F. L. N. Tuck (2nd Lieut. New Zealand Territorial Force); A. E. Turpin (2nd Lieut. R.F.A.); G. L. Walsh (Canadian Force); W. H. Walton (A.B. Anti-Aircraft Corps); A. G. Warren (Hong-Kong Volunteer Reserves); P. D. Webb (Calcutta Scottish Volunteers); R. H. Whittington (Lieut.); H. G. Wightwick (2nd Lieut. Singapore Volunteer Infantry); A. P. Williams (Australian Field Engineers); R. A.

Williams (2nd Lieut. R.E.); A. C. Wilmot (Staff Lieut.); J. L. Wilson (Lieut. R.E.); W. Winkworth (2nd Lieut.); A. E. G. Wood (Divisional Engineers, R.N.D.); J. Young (2nd Lieut.).

ASSOCIATES.

E. K. Abbott (Natal Carabiners); A. E. Brown (Capt. New Zealand Garrison Artillery); W. Brown (Hong-Kong Volunteer Reserves); Capt. T. C. Cunningham (R.G.A.); H. Fulton (Capt. and Hon. Major R.E.); R. Griggs (R.E.); Col. W. F. Hawkins (R.E.); R. H. Kent; Major M. C. Maunsell (Reserve of Officers); Rev. F. W. R. Metcalf (Chaplain R.N.); J. E. Newman (London Electrical Engineers); W. A. Quennell (Capt. A.O.C.); A. J. Saltren-Willett (Lieut.-Col. R.G.A.).

GRADUATES.

G. J. Baldock (Australian Artillery); F. L. Cater (A.S.C.); H. Cross (Lieut. Australian Force); F. C. Davies (Bombay Volunteer Rifles); I. Day (Hong-Kong Volunteer Reserves); J. P. Feloy (Lieut. R.G.A.); G. E. F. Graham (Wireless Telegraph Officer R.A.N.); L. T. G. Mansell (Lieut. A.O.C.); G. T. Medforth (Royal Canadian Engineers); C. E. Monks (2nd Lieut.); R. E. L. Owen (2nd Lieut. R.G.A.); E. A. Richards (2nd Lieut.); C. W. Saunders (New Zealand Engineers); W. J. Shaw (Lieut. A.S.C.); E. Wyatt (Divisional Engineers, R.N.D.); V. L. Wynyard-Wright (2nd Lieut. Indian Army).

STUDENTS.

G. D. Aspland (Lieut. R.E.); H. G. Baker (Divisional Engineers, R.N.D.); E. D. Begg-Robertson; B. L. Bishop (2nd Lieut. R.E.); H. Booker (Divisional Engineers, R.N.D.); H. A. Bower (Flight Sub-Lieut. R.N.A.S.); F. Carter; R. M. Clark (Divisional Engineers, R.N.D.); C. V. Clarke (2nd Lieut.); R. St. J. (New Zealand Force); B. C. Clayton (Flight Sub-Lieut. R.N.A.S.); C. Dawnay; I. G. D. de Grandpré (French Army); F. F. Duckworth (Hong-Kong Volunteers); R. C. Dunn (New Zealand Force); C. T. Eaddy; A. R. Fiske; N. V. Foote (Australian Light Horse); G. M. Friake (2nd Lieut.); J. E. Griffiths (H.A.C.); T. H. Hall (2nd Lieut. Cape Garrison Artillery); J. B. Hartley (Air Mechanic R.N.A.S.); L. D. Hill (Sub-Lieut. R.N.V.R.); E. R. Hillman; H. Hudson (Canadian Force); P. R. Hughes (2nd Lieut. R.F.A.); F. E. Hunt; E. H. James (Australian Fortress Engineers); D. H. Linsley (2nd Lieut. R.F.A.); B. S. Lion (2nd Lieut. R.E.); R. M. McNaught (2nd Lieut. R.E.); A. P. Mackie (New Zealand Engineers); E. Marks; E. L. Morgan (2nd Lieut. R.F.A.); F. T. F. Obert (London Electrical Engineers); B. H. O'Brien (R.E.); A. C. Pallot (2nd Lieut. R.E.); S. E. T. Pryce (2nd Lieut. R.A.); A. H. Pullan (2nd Lieut.); B. S. S. Rockey (2nd Lieut. R.E.); H. G. Seagrave; H. D. Shaw (R.E.); A. Shearman (2nd Lieut. R.E.); E. Simkiss (2nd Lieut.); J. B. Snell (2nd Lieut. R.E.); V. Soper (2nd Lieut.); C. D. Stoneham (2nd Lieut. R.E.); G. O. Tipping (2nd Lieut. R.E.); H. S. Tissah (Sub-Lieut. R.N.V.R.); R. H. N. Vaudrey (2nd Lieut. R.E.); H. C. Vereker (Flight Sub-Lieut. R.N.A.S.); E. H. Vick (R.E.); H. A. Voss (London Electrical Engineers); A. E. W. Wemyss (R.E.); D. Wilkin (R.E.); J. R. A. Willey; C. S. Williams (Divisional Engineers, R.N.D.).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

THE new session of the University of Liverpool begins on Tuesday, October 5th. The courses in Electrical Engineering are under Prof. E. W. Marchant, and Associate Professor A. Bromley Holmes. Prospectuses of the Faculty of Engineering may be obtained from the Registrar.

The courses in Electrical Engineering and other subjects at the Manchester Municipal School of Technology will commence as usual on October 5th. Matriculation and entrance examinations will be held in September. The school is in connection with the University of Manchester, and the principal is Mr. J. C. M. Garnett.

The annual report of the City and Guilds of London Institute states that the war had a very marked effect upon the entries of students for the session now running, and about 160 who would have returned enlisted or were called to the colours. In March of this year there were 402 students, as compared with 605 for 1913-14. Twenty-four of the teaching staff and workmen from South Kensington, and eight from Finsbury, are now serving in the Navy or Army. As far as is known 839 staff and past and present students are serving with the forces.

The programme of the City and Guilds Technical College, Finsbury, has also just been issued, and contains particulars of the courses in electrical and other branches of engineering, which will be held next session as usual. The electrical work is under Prof. Silvanus P. Thompson, and there are extensive facilities for laboratory work.

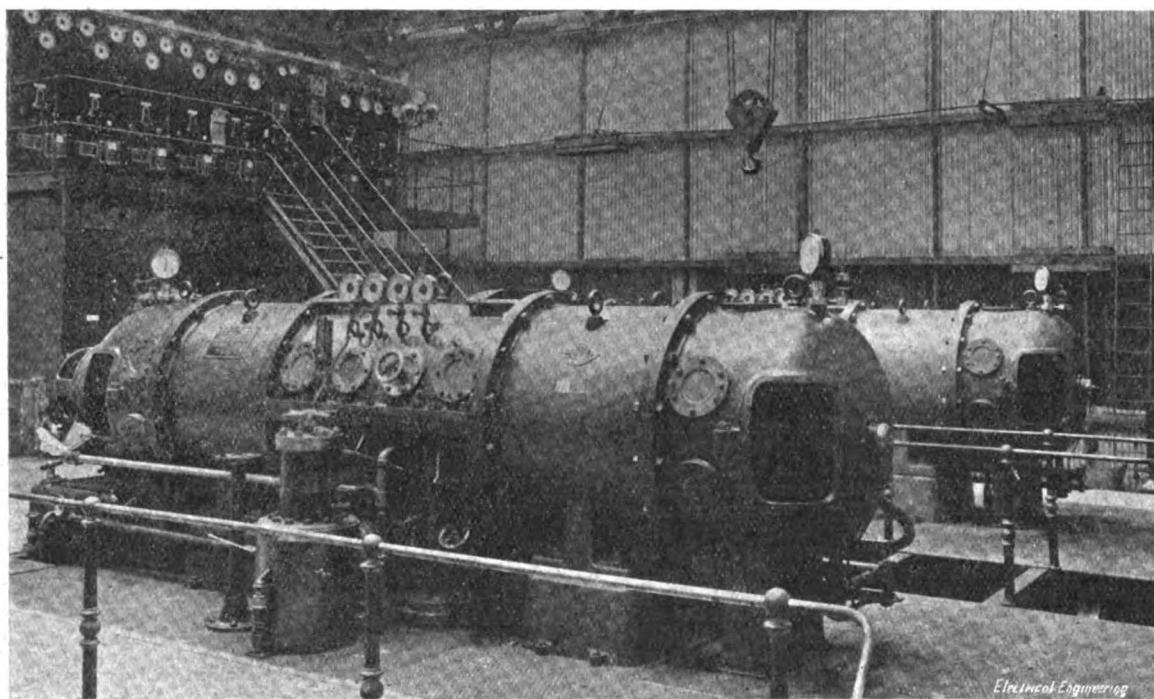
The following awards have been made in the Faculty of Engineering at University College:—Archibald P. Head Medal and Prize: B. C. Drummond. Studentship in Heating and Ventilating Engineering: G. F. Mitchell. Engineering Diplomas:—P. W. Baker (Mechanical); E. E. Barnard (Civil and Municipal); J. R. D. Bushell (Civil and Municipal); P. L. Capper (Civil and Municipal—with distinction); H. N. Charles (Mechanical); T. C. Chua (Civil and Municipal); B. C. Drummond (Mechanical—with distinction); H. Foad (Civil and Municipal); G. K. Pillai (Civil and Municipal); and S. L. Wong (Civil and Municipal).

1,000 K.W. LJUNGSTROM TURBO GENERATORS AT LUTON

WE have had the opportunity, through the kindness of Mr. W. H. Cooke (Borough Electrical Engineer, Luton), of inspecting the pair of 1,000-kw. Ljungström turbo-alternators, which have been at work in the Luton Electricity Works since last February. These sets were made by the Brush Electrical Engineering Co., and are generally similar to the set running at the St. Pancras Electricity Works, which was described in ELECTRICAL ENGINEERING, October 29th, 1914, page 561, and in this case also each consists of one turbine driving a pair of alternators in opposite directions, so that a very high relative speed is obtained between the two interleaved systems of blading attached to the shafts of the two machines. Each set is rated at 1,000 kw. at 6,600 volts three-phase 50 cycles, and the excellent steam consumption obtainable with this system is shown by the following guaranteed figures, which there is every expectation will be reached or even improved upon when the official tests come to be made:—Full load, 12·3 lb., and half load 13·7 lb. per kw.-hour. These figures are based on a power factor of 0·8 and 150 lb. per sq. in. steam pressure, with a total steam

gradually widening blading, leaving through a diffuser of multi-cellular construction and similarly widening channels and passing into the surrounding exhaust space. Labyrinth packing is provided at the shafts and between the revolving discs and the side discs, and the constructional details are of remarkable ingenuity, especially as regards the building up to the cages of blades, and their flexible attachment at alternate ends to the revolving discs. The most complete precautions have been adopted to avoid distortion from temperature effects. Summing up the general features, it may be said that the great economy obtained is due to the high relative blade speed, the small internal leakage, and the care taken to minimise radiation and other losses.

The blading rings are quite easy to remove and replace, and their construction renders them extremely strong. The provision for expansion is such that steam may be turned on rapidly without any gradual warming-up, and the presence of water does not apparently harm them. The sets run with so little vibration that a two-shilling piece can remain balanced on its edge on the casing when running at full load. The governing is entirely by throttle, with emergency trips actuated by hand, by rise of temperature of any bearing or by an independent overfeed device. The main governing is partly effected by the same oil pressure that feeds the



Electrical Engineering

1,000-KW. LJUNGSTROM TURBO-ALTERNATORS AT LUTON ELECTRICITY WORKS.

temperature of 700° F. and a 28-in. vacuum (barometer 30 in.).

Powers were obtained for the extensions in which these machines figure about two years ago, but delays in building operations were principally responsible for their not having been at work sooner. At the present time, they are practically fully loaded, and another 3,000-kw. set. A view of one of the complete sets, showing their remarkable compactness, is shown in the figure.

It will be remembered that the Ljungström turbine is in principle a reaction machine, although differing in construction radically from any other design. Briefly, it is a radial-flow turbine, in which the steam is admitted between two discs, and in its passage it passes between concentric blading rings, carried alternately by the two discs. The two discs revolve in opposite directions, and to the shaft of each is attached a generator. Notwithstanding the fact that two generators are employed, however, the complete set is extraordinarily compact for its output. There is no blading carried on split cast-iron casings, for it is all mounted on the concentric rings. This construction avoids risk of distortion when high superheats are adopted. The turbine is supported principally on the lower part of its casing, forming its exhaust branch, and can be mounted direct on the condenser without requiring separate foundations. The steam is led in by pipes within the lower part of the casing to chambers on either side of the discs, whence it passes through holes in them to the central annular space within the discs. It then passes radially through the

bearings. The weight of the set is mainly supported on the exhaust flange connected to the condensing plant below, the two feet under the generators being supported on springs. The condensing plant has no very unusual features; the pumps are all driven by D.C. motors, and can be supplied by the station battery in emergency. A Sturtevant wet-air filter is used in connection with the ventilation of the alternators.

The sets are placed in an extension of the main engine room built for the purpose, and containing a new switchboard by Johnson & Phillips, Ltd., with the necessary machine panels and several new feeder panels. The voltage is regulated by a pair of Brown-Boveri automatic regulators, one from each set. These act on the field circuits of the direct-coupled exciters with which each set is provided. Two new Woodeson water-tube boilers, each of an evaporative capacity of 30,000 lb. per hour, with underfeed stokers, have been provided in an extension to the boiler-room, which is of sufficient size to accommodate six more of the same size. Overhead bunkers of a capacity of 1,800 tons are provided. It is interesting to note that tests of this new boiler plant have shown an average of 0·15 lb. of coal per unit sold on actual load, whereas the corresponding figure to the old boiler plant was 0·38 lb. A new chimney shaft has been built for these boilers, and the extensions have also necessitated additions to the cooling tower equipment.

THE OSRAM v. POPE PATENT ACTION

THE hearing of this action was completed before Mr. Justice Joyce on Tuesday, and judgment has been reserved.

Mr. Ballantyne continued his evidence on Wednesday last week on behalf of the Pope Co., and denied that there was any moisture present at any stage in his experiments. Witness was cross-examined at considerable length by Mr. Walter, K.C., for the Osram Lamp Works, Ltd., the main result of which was that he differed from the chemical witnesses on the other side as to the chemical reactions which take place in working the Just and Hanaman patent.

Evidence in support of Mr. Ballantyne's views were given by Prof. F. G. Donnan, F.R.S., Professor of Physical and Inorganic Chemistry, University College, London; Mr. F. J. Gill, one time assistant to the late Mr. Robertson, of the Robertson Lamp Works, Hammersmith; and Mr. A. H. Rose. The latter stated that he had attempted to follow out the Just and Hanaman process, but failed to make what he termed a commercial filament. During the cross-examination of these witnesses it was suggested that the late Mr. Robertson at Hammersmith had been experimenting with the Just and Hanaman process at the time the first filaments were imported from Germany, and that he had failed to make satisfactory filaments in that way. At the close of the case for the defendants Mr. A. J. Walter, K.C., obtained leave to call Mr. C. Wilson, Commercial Manager of the Osram Lamp Works, Ltd., to explain the reasons why the late Mr. Robertson had been unable to make filaments according to the specification, but as it was elicited that Mr. Wilson only knew of the cause of the failure through conversations with the late Mr. Robertson, the judge held that this could not be admitted as first-hand evidence, and Mr. Terrell, K.C., for the defendants, objecting, the evidence was not admitted.

In making his final speech for the defendants, Mr. Terrell said that he would not go into the chemical details for discussing the various chemical reactions which took place in the process. His case, he maintained, was perfectly plain on the language of the specification as it had been drawn, and to attempt to go into all the remote reactions which took place in order to try to establish which reactions take place in such minute quantities was to him a hopeless task. Mr. Justice Joyce remarked that he did not think the case turned on this. Mr. Terrell then summed up the evidence in relation to the points already made for the plaintiffs by Mr. Hughes, K.C. (ELECTRICAL ENGINEERING, July 8th, p. 294).

Mr. A. J. Walter, summing up on behalf of the Osram Lamp Works, Ltd., contended on the question of infringement that the wording of the patent specification as to the heating of the filaments taking place in an atmosphere of steam and hydrogen did not imply that the steam and hydrogen was applied as a mixture to the filaments irrespective of anything taking place in the filaments. A discussion took place between the judge and Mr. Walter as to whether what was given off during the course of the defendants' process, and which was claimed by the plaintiffs to be steam, was in reality steam. Mr. Walter contended that it was steam inasmuch as true steam was invisible. Mr. Justice Joyce, however, said that they might have to read the specification in the popular sense that steam was a visible substance. On the other hand, Mr. Walter urged strongly that steam as popularly known was not steam, but a cloud of condensed water, and that in consequence any steam as known scientifically given off during the course of the defendants' process must bring it within the scope of the specification. Continuing, Mr. Walter said it was perfectly well known that passing dry hydrogen over oxide of tungsten produced steam, and that was why the defendants used oxide of tungsten. But for that there was no object in using oxide of tungsten. If nitrogen had been used instead of hydrogen, there would not have been infringement, because no steam would have been formed. Mr. Justice Joyce pointed out that the specification said that an atmosphere of steam and hydrogen was "introduced," but Mr. Walter replied that his reading of the specification was that this merely meant that an atmosphere of steam and hydrogen was present. The judge, however, did not agree.

In the course of further remarks, Mr. Walter dealt with the question of infringement, and the subject-matter in relation to the validity of the Just and Hanaman patent, and cited a number of well-known cases to prove that a patent could not be held to be invalid because it took a known process and applied it to a totally different metal. This was assuming that it was the Just and Hanaman process that had already been applied by Welsbach to osmium. He argued, however, that Just and Hanaman had produced an entirely new thing, and that before their patent and without it a tungsten filament lamp could not be made.

The Rugby Engineering Society.—The proceedings of this Society for the session 1913-14 contains among other items the following Papers, with reports of discussions thereon: "Some Recent Improvements in Power-Driven Forging and Stamping Plant," by W. Spencer; "The Electrical Design of Induction Motors," by H. L. Smith; "Electrical Accessories for Automobiles," by H. Procter; and "Power Economics for Intermittent Loads," by E. J. David.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS : We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS : A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,551.

A motor-generator for electroplating work is required to run off a 3-phase supply, and is to give out a current of about 8,000 amperes at a voltage variable between 4 and 8. Is it possible to obtain such a variation by the ordinary method of shunt regulation if the machine is self-excited, or is it better or necessary to arrange the fields for separate excitation? Could the variation in volts be satisfactorily accomplished by regulation on the motor side? What are the advantages or disadvantages of using carbon brushes as against copper gauze brushes on a generator of this size?

"W. M."

(Replies must be received not later than first post, Thursday, July 22nd.)

ANSWERS TO No. 1,449.

No reply of sufficient merit for an award has been received.

ANSWERS TO CORRESPONDENTS

J. M.—Overhead tramway feeders are used in a number of cases where the Board of Trade has no objection.

ALPHA.—The voltage between phases and earth of a 6,600-volt

3-phase system with the neutral earthed will be $\sqrt{3}$ = 3,800 volts.

With the neutral insulated or with a delta connected system it would theoretically be the same if the insulation resistance and capacity of all the phases are the same, actually it can be anything from this value to the extreme case of a dead earth on one phase when the other two will be at the full 6,600 above earth.

Diesel Engines.—In the course of a lecture to the Junior Institution of Engineers, Mr. W. A. Tookey referred to the many excellencies of design apparent in the Diesel engine constructed by British engineers, and called attention to various details of the operating mechanism. He also referred to the high rates of premium asked by insurance companies against breakdowns of Diesel engines. These, he thought, proceeded mainly from the over-stressing of cranks, and excessive heating of pistons, due to over-rating the permissible output from given cylinder dimensions. He was inclined to lay the blame not upon the technical men responsible for the details of construction, but upon those entrusted with the negotiations with prospective purchasers, who were particularly interested in being able to claim as small a ratio as possible in the relation between horse-power developed and capital cost. The lecturer proceeded to discuss the question of rating and the effect of the continuance of high mean effective pressures upon the piston, &c., consequent upon the use of rich mixtures coincident with full load and over-load. He then explained the manner in which the regulation of the fuel supply by the governing mechanism was effected and why it was necessary to vary the blast pressure with the load. He referred also to the regulation of the blast with different classes of liquid fuel, and mentioned a figure which it was inadvisable to exceed for mean effective pressure as a working load. He next dealt with the vexed question of over-load capacity, and concluded with references to the manipulation of details in starting, running, and stopping. Particular emphasis was laid upon the paramount importance of scrupulous cleanliness, which depended quite as much upon the personal attributes of the attendant as upon his technical ability.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 8th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

19,445/13. High Frequency Alternators. M. BRESLAUER. A high frequency alternator with the armature windings of full pole pitch arranged in the armature so that the centre line at right-angles to their plane is staggered in relation to centre line of the salient poles of the armature by half a pole pitch for the purpose of multiplying the number of alternations of the current without simultaneously increasing the number of reversals in the magnetisation of the iron. (Eleven figures.)

7,007/14. Voltage Regulators. B.T.-H. Co. (*A.E.G.*). An improved form of quick-acting voltage regulator arranged so that when the voltage variation is more than can be corrected by acting on the exciter field, a rheostat in the main exciter circuit is brought into action automatically by a voltage relay or otherwise. (One figure.)

7,200/14. Telephone Relay. C. STILLE. A microphone relay with two movably suspended coils rotatable opposite each other in a strong magnetic field, each coil carrying a number of arms, which bear against the contacts of a fixed microphone box. (Four figures.)

7,202/14. Transmission of Sound. C. STILLE. The sound waves impinge upon an arc in shunt with the primary of a transformer, the secondary of which is connected to a telephone receiver. (One figure.)

14,163/14. Conduit Joints. F. J. WINEBERG and E. T. PARKER. A continuity grip joint consisting of a sleeve formed of a single helical spring of substantial wire fitting tightly over the tube and clearing off the enamel while being forced on. (Two figures.)

19,908/14. Conduit Fittings. J. R. A. HEMMING and A. E. BECK. The combination with the socket of a conduit fitting furnished with a transverse hole and a screw pin, having at one side a recess to suit the side of the tube serrated, so that when the nut is tightened up the enamel is removed from the tube to make metallic contact. (Twelve figures.)

21,782/14. Engine Starter. A. H. MIDGLEY and C. A. VANDERVELL. An electrical engine starter for motor-cars of the class having an axially displaced armature, which draws the gear into mesh, provided with a friction disc arranged to come into engagement with the fly-wheel to start it moving before the gear is engaged. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Dynamos, Motors, and Transformers: A.E.G. [Protection of generators from fire in air filters] 24,450/13; SIEMENS-SCHUCKERTWERKE GES. [Synchronising rotary and cascade converters] 7,684/14; SIEMENS BROS. DYN. WKS., BRAMLEY and WISDOM [Commutators] 7,779/14; SIEMENS SCHUCKERTWERKE GES. [Diminishing flywheel windage] 7,868/14; ROSENBERG [Rotary converters provided with boosters] 8,385/14; PARSONS [Dynamos] 15,585/14; SIEMENS BROS. DYN. WKS. and KIEFFER [Cooling dynamos] 16,590/14; BURDON (Siemens Schuckertwerke Ges.) [Slot closing devices] 23,868/14.

Electrometallurgy and Electrochemistry: HIGHFIELD [Reduction of ores] 6,865 and 6,866/14; MASCHINENFABRIK SURTH GES. [Electrolytic apparatus] 8,367/14.

Heating and Cooking: FRANK [Radiators] 16,680/14.

Ignition: BURDON (*Siemens & Halske A.G.*) [Ignition apparatus] 23,791/14.

Incandescent Lamps: GLADITZ [Incandescent lamps] 24,029/13; B.T.-H. Co. (*A.E.G.*) [Incandescent lamps] 7,682/14; DANFORD and BRADLEY [Candle lamps] 14,669/14; SIEMENS BROS. & CO. and LE MARÉCHAL [Metal filament lamps] 15,329/14; JONES [Electric lamps and holders] 15,489/14; SABINE [Wire filaments] 15,617/14; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Incandescent lamps] 21,435/14.

Instruments and Meters: SIEMENS BROS. & CO. and GRINSTED [Fault indicator] 8,473/14; B.T.-H. Co. (*G.E. Co., U.S.A.*)

[Motor meters] 15,194/14; LINCOLN [A.G. Measuring instruments] 22,487/14.

Storage Batteries: NYA ACKUMULATOR AKTIEBOLAGET JUNGNER, A. T. H. ESTELLE and K. N. W. EVERE [Iron-cadmium battery electrodes] 7,338/09.

Switchgear, Fuses and Fittings: DAUM [Fuses] 15,749/14.

Telephony and Telegraphy: WITHERS (*Cox*) [Selenium cells for use in connection with telephony] 12,361/14; ROBERTS [Wireless receiver] 19,054/14; BLOGG and STERLING [TELEPHONE & ELECTRIC CO. [Intercommunication telephones] 21,955/14.

Traction: MCREYNOLDS [Trolley wheels] 7,214/14; BROWN, BOVERI & CIE. [Regenerative braking] 7,265/14; HOBHOUSE, SLINGO, GUNTON, and DOUGLAS [Railway system for mails] 14,984/14.

Miscellaneous: BECKMANN [Speed indicators] 3,020 and 3,021/14; GRISSEON [Cooling of Rontgen-ray tubes] 8,147/14; SCHMIDT & DOBSLAW [Pocket lamps] 8,353/14; MARTIN [Electric signs] 14,800/14; BRITISH INSULATED & HELSBY CABLES, LTD., BAXLES and HIGHAM [Condensers] 14,817/14; PEARSON [Lamp-holder with contacts for portable lamps] 18,870/14; BRUCK [Magnetic separators] 20,552/14; SAINT [Mercury contact for mining signal indicators, &c.] 1,453/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Ignition: POGNON [Sparkling plugs] 8,367/15; JOLY [Sparkling plugs] 8,717/15.

Miscellaneous: R. BOSCH [Lanterns] 5,866/15; VARLEY [Systems of producing electrical discharges] 9,111/15.

Applications to Avoid or Suspend Patents

Meters. 21,027/03, W. HAMILTON; 26,359/12 and 12,926/14, W. HAMILTON and FERRANTI, LTD. Applications regarding these patents by Ferranti, Ltd., will be heard by the Comptroller on July 15th. The first is for the general construction of a form of mercury motor meter, the second relates to details of the mercury trough, and the third is for improvements to facilitate removal of the disc.

Application for Amendment

9,582/14. Electric Railways. K. E. STUART. Leave is sought to correct a clerical error in this specification, which describes a system of driverless railways for the conveyance of mails, &c.

Opposition to Grant of Patents

28,527/13. Control Gear. R. AMBERTON. A grant has been allowed on this application, in spite of opposition. The specification describes a motor starter, in which the rheostat is electrically interlocked with electromagnetic circuit breakers.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:-

14,486/01 and 14,643/01. Electric Furnaces. J. IMRAY (*Société Electro-métallurgique Française*). The first of these describes an electric furnace for the production of wrought iron or steel, in which the metal bath is protected from contact with the electrodes and the slag, &c., is discharged at a level above the metal bath. In the second a form of furnace for such purposes which can be oscillated or tilted.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, Motors, and Transformers: CROMPTON & CO., J. C. MACFARLANE, and H. BURGE [Field magnets for converters] 7,060/09.

Electrometallurgy and Electrochemistry: J. HAWTHORNE [Electrolytic cleaning of metals] 22,625/07; F. PLATHNER [Electrolytic coating of metals] 92/08.

Telephony and Telegraphy: G. W. PICKARD [Oscillation detector] 10,772/09.

Traction: P. A. NEWTON (*Bliss Electric Car Lighting Co., U.S.A.*) [Train lighting] 6,854 and 6,855/02; H. LEITNER [Train lighting] 6,690/06.

Miscellaneous: F. STEINERT and H. STEIN [Magnetic separators] 6,323/08 and 6,267/09; W. LÖWENDAHL [Contacts] 6,412/08.

ELECTRIC TRACTION NOTES

As the result of arbitration, the employees in the electrical section of the L.C.C. Tramways Department earning up to 40s. per week are to receive a war bonus of 3s. per week. Some time ago this was granted voluntarily by the Council to men earning 30s. a week or less. The employees at the Greenwich power station applied for a general increase of 7s. per week, whilst the employees at the sub-stations made varying requests for increased rates of pay.

The estimated financial result of the L.C.C. Tramways for 1915-16 is a net deficiency of £91,614. The loss on the past year's working was £33,000, and the recent strike was responsible for a reduction in revenue of something like £100,000. The deficiency last year is to be met from the general reserve, but in view of the special circumstances arising out of the war and the strike, the Highways Committee has under consideration the possibility of arriving at some scheme for keeping the undertaking off the rates.

The draft agreement for the purchase by the Plymouth Corporation of the Devonport & District Tramways Company's undertaking has now been prepared.

In the last annual report of the Burnley Tramways Department it was stated that iron axles were being experimented with. Long experience, however, has shown that their life is, after all, too short, and the use of steel axles has been reverted to.

The Dover Corporation is arranging a contract with Edison Accumulators for the supply of six electric vehicles for departmental purposes. A first payment of £1,690 has been made.

The Annual Congress of the Tramways & Light Railways Association will be held at the Institution of Civil Engineers, Great George Street, Westminster, to-morrow (Friday). The following papers will be read and discussed: "Glimpses into the Obvious," a Paper on tramway management, by A. V. Mason, General Manager and Engineer, South Metropolitan Electric Tramways & Lighting Co.; "Tramways during War Time," by J. W. Dugdale, General Manager, Oldham Corporation Tramways; and "Electric Battery Vehicles as Adjuncts to Tramways," by W. H. L. Watson.

In connection with the annual written technical examination of commercial motor vehicle drivers, which was held

as usual this year by the Commercial Motor Users' Association, in spite of the Whit Monday parade being abandoned, a special electric-car drivers' prize of £5 with certificate has been awarded to J. Grove, employed by E. Nelson & Co.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

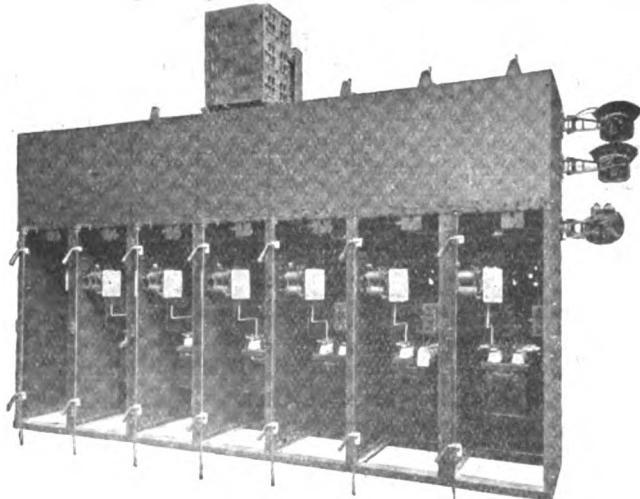
The *Electrical World* (New York) announces that the Nauen-Sayville and Hanover-Tuckerton transatlantic wireless systems, which have lately been transmitting the bulk of telegraphy traffic between the United States and Germany, have for the past two weeks suffered severe service interruptions. Although the plants have been found to be sufficiently powerful to interchange messages, even by daylight, during the winter season, with the coming of warmer weather (and the accompanying increase of "static") communication has become impossible for a large part of each day, and it is believed that commercial radio-telegraphy between the United States and Germany will not again be possible until autumn. At the present time the German War Office reports are transmitted through England. The Sayville transmitter is being enlarged so as to improve sending to Germany, but this will, of course, not aid reception in the United States. Many combinations of receiving apparatus are being tried both at Tuckerton and Sayville, in the hope of eliminating "static" interference to such a degree as to permit the German signals to be read.

A correspondent writes us as follows:—"Can you furnish me with any data regarding the influence of minerals in the earth upon wireless messages passing above them? I believe experiments made from balloons have demonstrated that the interference from the mineral deposits below extended above the altitude of the balloons. I am making some experiments in electrical mineral indication. How can I detect or measure the reflected waves which have rebounded from the obstruction of mineral in the ground, whose effect is added to that of the original waves?" Perhaps some of our readers can give the assistance asked for.

"ELECTRICAL ENGINEERING" TRADE SECTION

"WITTON" IRONCLAD HIGH PRESSURE SWITCHGEAR

AT the present time many manufacturers are finding it necessary to lay down plant for special purposes, and in



BACK VIEW OF "WITTON" BOILER PLATE MISTAKE-PROOF MAIN SWITCHBOARD.

such cases the benefits of electric driving are being very widely appreciated. In this connection totally-enclosed iron-

clad switchgear has many advantages, among which are that it occupies a small amount of room, requires no special foundations, can be rapidly erected, and makes a thoroughly permanent job. A representative example of a mistake-proof ironclad switchboard, as manufactured by the General Electric Co., Ltd. (Witton, and 67 Queen Victoria Street, E.C.) is shown in the accompanying illustration. This switchboard was constructed for a large steel works. It was built up of a number of "Witton" mistake-proof switch panels, each self-contained, and on arrival at the works the only erection work necessary was the connecting together of the different panels and the connecting up of the cables. This switchboard, which is one of a large number for similar orders now passing through the Witton works, was constructed to control, amongst other plant, a 750-kw. motor-generator manufactured by the General Electric Co., Ltd., to convert three-phase power at 3,300 volts, 50 cycles, to continuous current at 550 volts on the three-wire system, a static balancer being part of the equipment.

The "Beama" Journal.—The third issue of the official journal of the British Electrical and Allied Manufacturers' Association contains, among other contributions, articles on the electric industry in China and in Johannesburg. The needs of the industrial situation are also reviewed by Mr. J. Haworth, and Mr. L. Gaster has something to say on the progress of illuminating engineering. The only technical article is one by Mr. N. Shuttleworth on a method of speed regulation of induction motors. Several firms contribute illustrated notes on their activities and on novelties mostly already familiar to readers of our columns, and a large number of pages are filled by advertisements of members of the Association.

RAILWAY STATION LIGHTING BY OSRAM "ATMOS" LAMPS

A GOOD example of the use of gas-filled tungsten lamps for railway station lighting is presented by the Caledonian Railway Co.'s station at Glasgow. This station was originally lighted by 10-ampere open-type arc lamps with opalescent globes, running four in series on 230 volts, the total number of arcs employed being approximately 120. Inside the main entrance, containing the booking hall, offices, bookstalls, and waiting-rooms, the lamps were mounted



FIG. 1.—CENTRAL STATION, GLASGOW (CALEDONIAN RAILWAY), SHOWING SOME OF THE PLATFORMS ILLUMINATED BY OSRAM ATMOS TYPE LAMPS.

at a height of about 22 ft., and were spaced from 60 to 80 ft. apart. Along the platforms they were mounted at the same height, the average spacing being 80 ft. These arc lamps have now been replaced by 500-watt Osram Atmos type lamps. These occupy the positions previously occupied by the arc lamps. The result has been that there is a reduction of 300 watts on each circuit of four lamps, while at the same time the illumination of the station has been increased and



FIG. 2.—CENTRAL STATION, GLASGOW, BY DAYLIGHT, SHOWING DISPOSITION OF THE LAMPS.

considerably improved by the more even illumination obtained from the new lamps. Moreover, they require less attention. The horizontal illumination in the main hall of concourse is 2 ft.-candles maximum, with a minimum of 1'7 ft.-candles, while along the platforms the variation is between 0'8 and 1'6 ft.-candles. The photograph reproduced in Fig. 1 gives an idea of the brilliant effect obtained; and a general view by daylight, showing the old arc lamp carcasses, now containing the Osram Atmos type lamps, is given in Fig. 2.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Bradford.—An application is to be made to the L.G.B. for a loan of £20,000 for mains, &c., required for extensions in connection with war requirements.

Chesterfield.—A short time ago the L.G.B. declined to sanction a loan of £5,000 for new plant, but the matter has been pursued by the Corporation, and there is now a probability of the loan or some portion of it being allowed.

Dublin.—Supplies of cable and cable accessories, also transformers. City Electrical Engineer. July 26th. (See advertisement on another page.)

Edinburgh.—Tenders are invited for three, six, or nine

months' supply of electrical stores for the generating station. City Electrical Engineer. July 17th.

Erith.—A scheme for extending the electricity undertaking has, according to a local paper, been approved after discussion in private.

Halifax.—A loan of £24,000 is to be applied for in connection with new plant at the power station for war requirements.

London.—The linking-up scheme between the Battersea, Fulham, and Hammersmith generating stations is estimated to cost £24,989.

Sheffield.—In order to cope with the demands from factories working on Government contracts, it is necessary to instal new plant to the value of £10,500.

Wiring

Portsmouth.—Wiring and fitting of Wimborne Road school. G. C. Vernon-Inkpen, 40 Commercial Road. July 19th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Huddersfield.—Military hospital (£15,000).

Manchester.—Co-operative Stores, Openshaw. Mr. A. H.

Walsingham.—Factory, Derby Street. Architect, C. Swain.

Swansea.—Isolation hospital (£40,000).

Miscellaneous

Bradford.—A sum of £15,000 is to be spent on renewal of the tramway track.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London.—The Great Northern Railway Co. has placed an order with the General Electric Co. for a twelve months' supply of Osram drawn wire lamps and Osram "Atmos" type lamps.

Market Drayton.—The Council has decided to accept a tender by the Electric Lighting Co. for street lighting.

The British Thomson-Houston Co. has received an order through G. & S. Massey, of Manchester, for 98 special Fabroil pinions for power hammers for the French Government to be used in a French munition works.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. W. Spark, Electrical Engineer and Manager of the Devonport electrical undertaking of the Plymouth Corporation, has been appointed, on the recommendation of Sir John Snell, to the post of Chief Electrical Engineer at West Hartlepool. The commencing salary is £400 per annum, and there were 92 applicants for the appointment.

Mr. A. R. Courtenay (late Acting Manager of the Publication Department of the General Electric Co.) was gazetted on May 20th Sub-Lieutenant in the Royal Naval Air Service, armoured Car Aeroplane Support (Royal Naval Volunteer Reserve), and is now undergoing a course of gunnery.

Mr. Spencer Hawes has been appointed Managing Director of the Reading Electric Supply Co., Ltd. Mr. E. Rowley Hill retired from the post of Engineer and Manager at the end of June last.

Mr. A. G. Ellis (of Brown, Boveri & Co., Switzerland) was married on June 7th last at Hythe to Miss E. H. Price.

Mr. C. H. Thorpe, Engineer-in-Charge at the Hammersmith electricity works, has resigned.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £93 to £94 (last week the same).

Advance in Prices.—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) have had to advance the prices in the M. (instruments) section of their catalogue by 20 per cent. with the exception of meggers and time-switches. The prices of ammeters are cancelled, and quotations can be given on application. The prices of recording and indicating wattmeters (Pamphlet M. 1,711) are advanced 10 per cent.

Sanitas Electrical Co.—It is stated that all the directors of the Sanitas Electrical Co., Ltd., being resident in Berlin it is impossible to hold an annual meeting this year. As a matter of fact, the Company's business was suspended on August 17th last year, the Secretary has resigned, and there is not anybody to represent the Company except the solicitor, who has explained the position to the Registrar of Joint Stock Companies. The *Financial News* drew attention to the above in a recent issue.

Liquidations.—The Electrical Power Storage Co. has gone into voluntary liquidation in connection with the reconstruction of the Company following the amalgamation with Pritchett & Gold. The new Company is known as Pritchett & Gold and Electrical Power Storage Co., Ltd.—A meeting of creditors of Venners' Electrical Cooking and Heating Appliances, Ltd., will be held on July 22nd at 12.30 p.m. at Blomfield House, London Wall, E.C.

LOCAL NOTES

Aberdeen: War Loan.—It has been decided to invest £5,000 from the reserve fund into the new War Loan.

Edinburgh: Electric Supply Deficit.—The Lighting Committee recommend that the deficit last year of £6,200 be paid out of the reserve fund, and that the charge for private lighting should be increased by ½d. per unit, that for power remaining as at present, viz., 1½d. per unit. It should be pointed out that the policy of the Edinburgh Corporation has been to so fix their charges from year to year that in normal times the expenditure and receipts practically balance, after full provision for reserve and depreciation. Obviously the war was bound to affect the estimates prepared last year.

Maidstone: Loan Granted.—The L.G.B. has sanctioned a loan of £4,800 for new plant. The Corporation had entered into a provisional contract with the Brush Electrical Engineering Co. for a Ljungstrom turbine, and the amount now sanctioned is the cost of the plant, less £2,150 received from the sale of three small generating sets, and £500 to be paid out of revenue.

Manchester: Electricity Accounts.—There was a net profit of £34,926 upon the working of the electricity undertaking last year, after meeting capital charges and transferring £25,618 to renewals suspense account. This net profit compares with £36,000 in the previous twelve months. A sum of £30,000 has been transferred to relief of rates, and the balance has been absorbed in capital outlays, for which no borrowing powers exist. It is noted in the Committee's report that apart from checking the normal development of the Department, the war has had the effect of reducing the surplus by reason of war service allowances, amounting to £6,015, and additional income tax of £3,283. At the Stuart Street power station Messrs. James Howden have completed the installation of a 15,000 kw. turbo-alternator, but owing to unavoidable delays the official trials have not been made. A contract has been placed with the British Westinghouse Co. for a 6,000 kw. turbo-alternator, which will replace an existing Yates & Thom-A.E.G. reciprocating engine set. At the Dickinson Street power-house Messrs. Bruce Peebles have now completed the installation of an additional 2,200 kw. motor-converter. A supply of current at 11,000 volts to the Middleton Corporation has been commenced. The efficiency of the system was 85·87 per cent., and the units unaccounted for 14·13 per cent., the latter being a decrease of 1·38 per cent. on the previous year.

Oldham: Municipal Wiring.—A short time ago we referred to a scheme of the Education Committee for lighting one of the schools which had been placed in the hands of the Electricity Committee at a cost of £200. This led to a dis-

cussion at the Council meeting last week, when an unsuccessful effort was made to have the matter referred back. The opinion was expressed on the one hand that the work of the Electricity Department was to provide and distribute current, and not to carry out installations, but on the other hand it was urged that there was nothing harmful or unfair in one Committee doing work for another. The proposal was eventually carried.

Plymouth: Municipal Wiring.—On page 206 of our issue for May 18th we referred to the position with regard to municipal wiring in the new borough of Plymouth in reporting the proceedings before a House of Lords Committee. The old Devonport Corporation had full municipal wiring powers, and it was asked that these should be extended to the new borough of Plymouth, which included Plymouth and Devonport. There was some opposition by the Plymouth Mercantile Association, and Mr. Leonard Tate, Secretary of the Electrical Contractors' Association, was in attendance. In the end, however, the Committee granted the new borough of Plymouth full wiring powers without the intervention of the contractor. It was anticipated that there would have been considerable opposition when the Bill came before the House of Commons, but this was not so, and the Local Legislation Committee last week passed the clauses as sanctioned by the House of Lords.

Sunderland: Electricity Accounts.—The total output for the year to March 31st, 1915, was 14,499,124 units, which is a decrease of 2½ per cent. on the previous year. The power output has practically remained constant, being nearly 0·075 per cent. below that of the previous year, and moreover the demand continues, five new sub-stations having been completed. After meeting capital charges there is a balance of £4,653.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

General Electric Co.—At the annual meeting last week the report and accounts given in our July 8th issue were adopted. Mr. H. Hirst, who was in the chair, referred to the effect of the war upon the company's business, and to the fact that in the early days factors and the trade, fearing a shortage of supplies, decided to fill up their stocks and indulged in over-buying; consequently the company's stock had been considerably reduced, and had not yet been sufficiently replenished owing to reduction of output, shortage of labour, and lack of raw materials. In referring to the "well meant but ill-conceived" Press attacks on the Osram Lamp Works, Ltd., owing to the prevalence in that company of German capital, Mr. Hirst said that the Press did not sufficiently distinguish between German-owned trading concerns and factories in this country, which were useful and essential to national purposes. The importance of the Hammersmith Works, not only to the company but also to the Government and the country, was very great, and it was therefore gratifying to announce that a way had been found, with the knowledge of the Treasury and the Public Trustee, which would give the future control of these works, he trusted for ever, into British hands. About one thousand of the company's staff are now serving with the forces, of which eleven have already lost their lives, and fifty are invalided, wounded, or missing. In this connection reference was made to the unfortunate death of Mr. Harry Byng at the front, and to the fact that the company is keeping open the positions of those who have enlisted, and has made arrangements for allowances to their dependants. Dealing with the work now being carried on for the Government, it was mentioned that this includes the supply of searchlight carbons, signalling and wireless apparatus, incandescent lamps, both carbon and metal filament, power, lighting and ventilating plant for H.M. Dockyards and battleships, motors, dynamos, and every kind of electrical equipment for the Army Service Corps, hospitals and munition works, &c., field telephones and batteries, targets, exploders and shells for both services. A start has been made in the manufacture of certain types of shells, and arrangements are in progress by which the company will make itself thoroughly efficient in this department. In order to cope with the increased work created by the growth of the business, it was found necessary to add to the number of directors, and three members of the staff were selected, viz., Mr. J. Y. Fletcher, Manager of the Osram lamp business; Mr. S. D. White, who is in charge of all Government work carried on by the company; and the late Mr. George Maurice. Unfortunately, however, as our readers are aware, Mr. Maurice lost his life when the *Lusitania* was sunk by a submarine. The company has invested £200,000 in the War Loan.

Newcastle-on-Tyne Electric Supply Co.—An interim dividend of 2½ per cent. is declared on the preference shares, but an interim dividend on the ordinary shares has been postponed owing to the uncertainty of the present situation.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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SUMMARY

THE annual report of the National Physical Laboratory records a considerable diminution of the staff due to the war, and a certain amount of rearrangement of the work. A good deal of Government work is being carried out (p. 310).

WE give the names of the Central Committee of the Inventions Board, which has been appointed to assist the Admiralty, and also a list of consultants who will advise on any matters referred to them (p. 310).

SOME notes are given on the forthcoming sessions, &c., of some of the Universities and Technical Colleges (p. 310).

THE Government Bill limiting the price of coal was read a second time in the House of Commons on Monday. Varying views are held with regard to it, and there may be some alterations made when the Committee stage is reached (p. 311).

WE explain the position with regard to the "model" wiring and fittings clause in relation to the position at Plymouth (p. 311).

MR. JUSTICE JOYCE on Tuesday dismissed the action for alleged infringement by Pope's Electric Lamp Co., Ltd., of the Just and Hanaman metal filament lamp patent No. 23,899 of 1904. The Osram Lamp Works, Ltd., will appeal, and it is intimated that the case will be carried to the House of Lords (p. 311).

An effect due to capacity on a three phase system is discussed in our Questions and Answers column (p. 312).

An example of electric driving of textile machinery is contained in an illustrated article (p. 313).

A DIVIDEND of 10 per cent. is recommended on the ordinary shares of Marconi's Wireless Telegraph Co., against 20 per cent. last year (p. 313).

AMONG the specifications published at the Patent Office last Thursday were several relating to metal filament lamps, and others in connection with commutator construction, electric railway control and locking lamp-holders (p. 314).

AT the annual meeting of the Tramways and Light Railways Association last week the serious position which has arisen owing to difficulty in obtaining supplies of wheels, axles, tyres, &c., was discussed. A paper was read on the electric vehicles as an adjunct to tramways, and experiments with a change speed mechanism were mentioned (p. 315).

A DESCRIPTION is given of the electric power installation in a bakery (p. 315).

A NEW electric fire is described (p. 316).

AN expenditure of £15,000 is contemplated at Barnsley; switchgear is required at Keighley; motors in Australia; cable and meters at Rotherham; cable at Aylesbury. The Bethnal Green supply scheme is to be proceeded with (p. 317).

THE "Northumberland" Clause has been imposed upon the Southampton Corporation in respect of a small extension of area.—A fault recently took place on the Oldham mains through a cable being laid in direct contact with a gas main.—A large extension scheme at St. Pancras is to be reduced by half owing to the war (p. 318).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING JULY 31ST, 1915.
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, Wednesday, and Friday :—Drills 6.30 and 7.30.
Applications for Enrolment :—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING.
(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

THE NATIONAL PHYSICAL LABORATORY

THE report of the National Physical Laboratory for the year ended March 31st, 1915, records that the work of the Laboratory has been greatly affected by the war. About 50 members of the total staff of 210 have joined the colours, and considerable reorganisation has been necessary. The financial results have been adversely affected. Up to the end of June the receipts for work done were considerably in excess of those for the corresponding three months of the previous year, but during July, August, and September there was a fall amounting to some £2,100. Since September, however, there has been a considerable recovery, and the results are less unsatisfactory than had been feared. When the call came for the formation of the new Army, it was clear that some selection would have to be made among those who wished to join; the demands on certain divisions of the Laboratory for work for war purposes were very severe, and many of the staff who were prepared to volunteer could not be spared. To these who were retained at Teddington the Government badge, "On War Service," has been issued; the rest entered various branches of the Services, and are now in various parts of the world. Some are at the Front, a large party joined the 6th East Surrey Regiment, and have gone to India. Dr. Kaye, as a Captain in the London Electrical Engineers, has had charge since August of the searchlights along a stretch of 150 miles at the mouth of the Thames. Mr. Millar went to Antwerp with the Royal Naval Volunteer Reserve, was taken prisoner, and is now at Döberitz. Forty-two members of the staff have been enrolled as special constables, and some take part in patrolling the grounds. Those remaining at the Laboratory have been very fully employed, and a large number of requests for advice and assistance have been received from the Admiralty and the War Office and other Government departments. In addition to the aeronautics work, the time of a number of the senior members of the staff has been given almost entirely to war research.

Amongst other activities during the year, it may be mentioned that the Committee on the Lighting of Factories and Workshops, of which the Director is Chairman, and Mr. Paterson Secretary, have completed their first report. The Director (Dr. Glazebrook) has been much occupied as Chairman of a sub-committee of the Engineering Standards Committee on the rating of electrical machinery. With regard to the work of the Physics Department, the report of the Executive Committee continues as follows:—

In the Electrical Standards Division Mr. F. E. Smith again calls attention to the great accuracy with which the fundamental electrical standards can be reproduced. It has not been possible to obtain the exact figures which result from the comparison made by Mr. F. E. Smith and Dr. Giebe between the absolute measurements of resistance at the National Physical Laboratory and the Reichsanstalt, but it is known that the agreement is very close. A comparison between five mercury resistance tubes made and calibrated at the N.P.L., and five constructed at Tokio, shows a mean difference of eight parts in one million, while Weston cells made at Petrograd were found to agree with the Laboratory Standards to within one part in one hundred thousand. The comparisons of some standards of inductance made by Dr. Giebe and Mr. Campbell are equally satisfactory. Mr. Campbell's valuable paper on the measurement of large high-frequency currents must be mentioned; he and Mr. Dye have extended the range and added to the accuracy of their high-frequency measurements in a marked manner. In the Alternating Current Measurements Division much has been done to improve the accuracy of the measurements and to accelerate the work. The increased volume of the work makes it necessary to increase the speed wherever possible, and additional equipment has been provided with this object. The tests in the direct current division have increased largely, in consequence of the war; the research work has dealt chiefly with the rise of temperature of underground cables, and thanks to the cordial co-operation of the engineers in a number of large centres, Mr. Melsom, who has devoted much time and energy to the work, has obtained a series of interesting results which will in due time be communicated to the Institution of Electrical Engineers, at whose cost the research is being carried out. Mr. Paterson has communicated to the Physical Society two most interesting photometric papers. One of these deals with the methods by which the values of the high-efficiency Electrical Standards have been determined, and the Committee take this opportunity of thanking the General Electric Co. for their generosity in presenting a very complete series of standard lamps made specially at the Osram Lamp Works. The other research has led to formulæ connecting the light emitted per watt with the temperature of the filament, for both carbon and tungsten lamps, and is of great interest.

The total number of electrical measurements made in the Physics Department during the year was 191, as against 259 for the previous year, but the tests in the electrotechnics division

increased from 3,823 to 5,080. In the Photometry Division, however, the number of tests declined from 1,142 to 410. Further details of the work of the various departments are given in the Director's report.

In the Metallurgical Department a new electrically-driven rolling mill has been put to work, and in connection with this a 1,000-ampere-hour 120-cell Tudor battery and a new motor booster set have been installed in the power house.

THE INVENTIONS BOARD

IN connection with the announcement made early in the month that Lord Fisher had been appointed Chairman of an Inventions Board which has been established to assist the Admiralty in co-ordinating and encouraging scientific effort in its application to the requirements of the Naval Service, it is now stated that the organisation of the Board has been completed. It will comprise a Central Committee and a Panel of Consultants consisting of scientific experts, who will advise the Central Committee on any matters referred to them.

The Central Committee will consist of Lord Fisher, Sir J. J. Thomson, F.R.S., the Hon. Sir C. A. Parsons, F.R.S., and Dr. G. T. Beilby, F.R.S.

The consulting panel will consist of the following, which, however, may be added to from time to time as events may prove necessary:—

Professor H. B. Baker, F.R.S. (Professor of Chemistry, Imperial College), Professor W. G. Bragg, F.R.S. (Professor of Physics, Leeds University), Professor H. C. H. Carpenter (Professor of Metallurgy, Imperial College), Sir William Crookes, O.M., F.R.S., W. Duddell, Esq., F.R.S., Professor Percy Frankland, F.R.S. (Professor of Chemistry, Birmingham University), Professor Betram Hopkinson, F.R.S., Sir Oliver Lodge, F.R.S., Professor W. J. Pope, F.R.S. (Professor of Chemistry, Cambridge), Sir Ernest Rutherford, F.R.S., G. Gerald Stoney, Esq., F.R.S., Professor the Hon. R. J. Strutt, F.R.S. (Professor of Physics, Imperial College).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

Among the examination results in the Faculty of Engineering at the University of Bristol the following relate to the electrical engineering final examination for the certificate:—(Pass) R. J. Perry. Final examination for B.Sc. second-class honours, S. Bartlett; pass, E. G. Moody and L. G. H. Sarsfield.

The full four-year course in electrical engineering at the University of Birmingham, which qualifies for the degree of B.Sc., will commence as usual in the autumn, the session opening on October 5th. The electrical engineering department is under Professor G. Kapp, who is assisted by Messrs. E. J. Kipps and T. F. Wall as lecturers. The Principal of the University is Sir Oliver Lodge, F.R.S. Full particulars of the courses can be obtained from the Secretary.

The complete courses of instruction provided at the City and Guilds (Engineering) College, South Kensington, which forms the engineering section of the Imperial College of Science and Technology, lead up to and include the highest specialised instruction for students, with the object of fitting them to take leading positions as electrical engineers, investigators, advisers, and experts, and those qualified who desire to take up more advanced courses of training and research in connection with those branches in which they are specially interested. The department of electrical engineering is under the direction of Prof. T. Mather, F.R.S., and that of mechanical engineering and motive power is under Prof. W. E. Dalby, F.R.S. Further information may be obtained from the Registrar.

Half-watt Lamps for Street Lighting in New York.—According to the *Electrical World*, during the last six months upwards of 10,000 arc lamps have been replaced by an equal number of half-watt lamps of various sizes from 300 to 1,000 watts. While this substitution was made on a lamp-for-lamp basis, the size in each case was determined by the illumination demands of the immediate vicinity, as follows: Large squares at intersecting streets and junction points, 750-watt lamps; important thoroughfares, 500-watt lamps; crosstown thoroughfares, tree-lined or parked avenues, and streets and avenues with car lines, 400-watt lamps; mercantile and wholesale districts, residence streets and small parks, 300-watt lamps. Approximately 600 multiple-arc lamps in use on the bridges connecting the several boroughs have also been replaced by 300-watt gas-filled tungsten lamps. These lamps are divided between those of the bowl-frosted type, installed with socket housings having an elongated neck reflector coming well down over the neck of the lamp and without the usual globe inclosure, and those in standard housings. The lamps without inclosing globes are of the straight-sided, pear-shaped type, and have withstood local climatic conditions and traffic vibrations satisfactorily.

COAL SUPPLIES

THE Board of Trade introduced a Bill into Parliament on Wednesday last week limiting the price of coal. Briefly, it provides that the price at the pit-mouth shall not be more than four shillings per ton in excess of the price obtaining twelve months ago. In special circumstances the Board of Trade may increase this difference where the conditions warrant it. The Bill, however, does not apply to contracts already made.

This point has been a matter of some discussion, and opinions are held that the Bill, which passed its second reading in the House of Commons on Monday, is to a large extent useless for the purpose of keeping down prices during the coming winter, inasmuch as most contracts have already been entered into. The case for the Bill, however, is that in the absence of such a measure there would have been the likelihood of much higher prices being charged than last winter. On the whole, therefore, it would seem that electricity supply undertakings need not anticipate any appreciable reduction in their coal costs in the near future. The Board of Trade admits that the task of dealing with existing contracts would be much too complicated, but London merchants, at any rate, have agreed with the Government not to charge higher prices than are necessitated by the extra costs, and have placed their books at the disposal of the Board of Trade. This confirms the general view of London electricity undertakings which deal through merchants, viz., that throughout last winter the merchants did their utmost to act up to their pre-war contracts, and at the conference held at the Institution of Electrical Engineers several speakers mentioned this fact.

It is possible that when the Bill is considered in Committee some amendments will be made. It is significant that Sir Arthur Markham, a colliery owner, should protest against a standard increase of 4s. per ton. He suggests that 2s. would be nearer the extra cost to which colliery owners have been put. On the other hand, other colliery owners during the course of the second reading debate protested against the coal industry being singled out for treatment in this way, but a motion for the rejection of the Bill was withdrawn.

MUNICIPAL WIRING POWERS

THE reference on page 302 of our last issue to the fact that the "Model" Wiring Clause had been inserted in the Plymouth Corporation Bill by the Lord Chairman of Committees after a House of Lords Committee had granted the Corporation powers to wire without the intervention of a contractor, may perhaps need a little further explanation as to the meaning of the "Model" Clause. The authorities of Parliament who deal with private Bill legislation have a set of "Model" clauses capable of application to electric supply, railways, tramways, &c., which are added to and modified from time to time. These clauses relate to matters usually of a non-controversial nature, and represent for the time being the settled policy of Parliament with regard to these details. Consequently any promoter coming to Parliament for powers covered by these clauses has to show a very special case before any deviation from them will be allowed by those whose duty it is to scrutinise the Bills before they reach Committees of either House. This, of course, does not take away the right of the Committee to grant such powers as it thinks fit, but, as in the Plymouth case, alterations can be made even after a Committee has given its decision in favour of a modification of the "Model" Clause.

The position with regard to the "Model" Wiring Clause is that, before the introduction of the first I.M.E.A. Bill, a clause was introduced into the set of "Model" clauses stipulating that where a municipal undertaking takes powers to wire and fit consumers' premises the work must be placed in the hands of a contractor. This has been the uniform practice since that date, and, of course, the strong opposition to the I.M.E.A. Bill has been due to the fact that this latter would modify the present "Model" Clause. If the I.M.E.A. Bill had been passed, the "Model" Clause would have been altered accordingly. As pointed out on page 127 of our issue for March 5th, however, the latest I.M.E.A. Bill differs in many respects from its predecessors, for it concedes to the contractors the point that all wiring work shall be sub-let to a contractor where there is more than one electrical contractor in the district, giving to municipalities, however, the powers to hire and sell electric lighting and heating apparatus with due protection to the contractors from any under-selling. But this, as our readers know, does not meet with the approval of the contractors except in Scotland. Still, it is obvious that

at the present time no good purpose would be served in introducing the I.M.E.A. Bill into Parliament even if an opportunity could be found.

THE OSRAM v. POPE PATENT ACTION

Judgment for Pope Co.

M R. JUSTICE JOYCE gave judgment on Tuesday in the action by the Osram Lamp Works, Ltd., for alleged infringement by Pope's Electric Lamp Co. of the Just and Hanaman patent No. 23,899 of 1904. The proceedings in the case were reported in our issues for July 1st, p. 288; July 8th, p. 294; and July 15th, p. 304. Premising his remarks by stating he had received the hint that the case would go to the House of Lords on appeal, Mr. Justice Joyce read the following passage from the specification as constituting the material part of it for the purposes of the action and as representing the process described by the patentees :—

For the manufacture of filaments of this kind finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide as mixed with an organic binding medium, such as collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide or the like, from which mass filaments are formed in the usual manner, and are then carbonised, in some instances after denitration has previously been effected. The filaments so produced and consisting of tungsten and carbon are then submitted to the following further treatment.

First of all the carbon, which has only served as a binding medium, is removed by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen, and thus raising it to a high temperature. By this process the carbon is completely oxidised so as to form carbonic oxide and a filament of tungsten is left. These filaments are then rendered uniform in a manner similar to that employed in the treatment of the usual carbon filaments, by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen whereby the tungsten deposited equalises the filaments. The filaments which have been rendered uniform in this way are then sealed in glass bulbs in the usual manner, and these latter are exhausted.

It appeared from the evidence, continued his Lordship, that the usual manner of forming filaments referred to in the above extract from the specification was to make the materials into what was termed a compound having the consistency of thick treacle, which was then squirted through a glass nozzle. The defendants, however, made a much thicker paste. Then there was the question of carbonisation. The specification carried this out in the usual manner, and there was some dispute as to whether defendants carried out their carbonisation in the usual manner. It was denied with some show of reason that the defendants did so. He had some doubt whether they did so or not, but as to whether the defendants used the series of processes described in the patent, or, indeed, any of them, he did not feel much doubt. Rightly or wrongly, he did not think they used any one of them. They certainly did not pass a current through the filament, and the filaments were not subjected to the passage of current in an atmosphere of steam and hydrogen. In his opinion the defendants did not use an atmosphere of steam and hydrogen in the sense in which the phrase was used in the specification or was intended by the patentees; nor, indeed, did the defendants use steam at all in the ordinary sense of the word. He understood steam to be water-vapour. The dictionary he had consulted described steam as "the hot vapour given off at boiling point," although it was added that true steam was invisible, the white cloud termed steam being a collection of fine drops of water formed by condensation. The hydrogen used by the defendants was dry, but it was said by the plaintiffs that an infinitesimal amount of water-vapour was formed during the process which constituted steam in the scientific sense. That might be so, but it was certainly not subjecting the filaments to the passage of a current in an atmosphere of steam and hydrogen, as described or indicated in the patent. Nor was the defendants' process an equivalent process. In the circumstances, seeing how many of the steps described in the specification were omitted from the method adopted by the defendants, and alleged to constitute infringement, he was unable to bring himself to the conclusion that the patent had been infringed by the defendants. He therefore held that the patent had not been infringed, and the action must be dismissed with the usual costs.

As to the validity of the patent, had it been necessary for him to go into this, he would have had serious doubts on the matter, not only as to subject matter, but as to the sufficiency of the instructions given by the patentees.

It was intimated that the Osram Lamp Works, Ltd., will give notice of appeal immediately.

THE NATIONAL PHYSICAL LABORATORY

THE report of the National Physical Laboratory for the year ended March 31st, 1915, records that the work of the Laboratory has been greatly affected by the war. About 50 members of the total staff of 210 have joined the colours, and considerable reorganisation has been necessary. The financial results have been adversely affected. Up to the end of June the receipts for work done were considerably in excess of those for the corresponding three months of the previous year, but during July, August, and September there was a fall amounting to some £2,100. Since September, however, there has been a considerable recovery, and the results are less unsatisfactory than had been feared. When the call came for the formation of the new Army, it was clear that some selection would have to be made among those who wished to join; the demands on certain divisions of the Laboratory for work for war purposes were very severe, and many of the staff who were prepared to volunteer could not be spared. To these who were retained at Teddington the Government badge, "On War Service," has been issued; the rest entered various branches of the Services, and are now in various parts of the world. Some are at the Front, a large party joined the 6th East Surrey Regiment, and have gone to India. Dr. Kaye, as a Captain in the London Electrical Engineers, has had charge since August of the searchlights along a stretch of 150 miles at the mouth of the Thames. Mr. Millar went to Antwerp with the Royal Naval Volunteer Reserve, was taken prisoner, and is now at Döberitz. Forty-two members of the staff have been enrolled as special constables, and some take part in patrolling the grounds. Those remaining at the Laboratory have been very fully employed, and a large number of requests for advice and assistance have been received from the Admiralty and the War Office and other Government departments. In addition to the aeronautics work, the time of a number of the senior members of the staff has been given almost entirely to war research.

Amongst other activities during the year, it may be mentioned that the Committee on the Lighting of Factories and Workshops, of which the Director is Chairman, and Mr. Paterson Secretary, have completed their first report. The Director (Dr. Glazebrook) has been much occupied as Chairman of a sub-committee of the Engineering Standards Committee on the rating of electrical machinery. With regard to the work of the Physics Department, the report of the Executive Committee continues as follows:—

In the Electrical Standards Division Mr. F. E. Smith again calls attention to the great accuracy with which the fundamental electrical standards can be reproduced. It has not been possible to obtain the exact figures which result from the comparison made by Mr. F. E. Smith and Dr. Giebe between the absolute measurements of resistance at the National Physical Laboratory and the Reichsanstalt, but it is known that the agreement is very close. A comparison between five mercury resistance tubes made and calibrated at the N.P.L., and five constructed at Tokio, shows a mean difference of eight parts in one million, while Weston cells made at Petrograd were found to agree with the Laboratory Standards to within one part in one hundred thousand. The comparisons of some standards of inductance made by Dr. Giebe and Mr. Campbell are equally satisfactory. Mr. Campbell's valuable paper on the measurement of large high-frequency currents must be mentioned; he and Mr. Dye have extended the range and added to the accuracy of their high-frequency measurements in a marked manner. In the Alternating Current Measurements Division much has been done to improve the accuracy of the measurements and to accelerate the work. The increased volume of the work makes it necessary to increase the speed wherever possible, and additional equipment has been provided with this object. The tests in the direct current division have increased largely, in consequence of the war; the research work has dealt chiefly with the rise of temperature of underground cables, and thanks to the cordial co-operation of the engineers in a number of large centres, Mr. Melsom, who has devoted much time and energy to the work, has obtained a series of interesting results which will in due time be communicated to the Institution of Electrical Engineers, at whose cost the research is being carried out. Mr. Paterson has communicated to the Physical Society two most interesting photometric papers. One of these deals with the methods by which the values of the high-efficiency Electrical Standards have been determined, and the Committee take this opportunity of thanking the General Electric Co. for their generosity in presenting a very complete series of standard lamps made specially at the Osram Lamp Works. The other research has led to formulae connecting the light emitted per watt with the temperature of the filament, for both carbon and tungsten lamps, and is of great interest.

The total number of electrical measurements made in the Physics Department during the year was 191, as against 259 for the previous year, but the tests in the electrotechnics division

increased from 3,823 to 5,080. In the Photometry Division, however, the number of tests declined from 1,142 to 410. Further details of the work of the various departments are given in the Director's report.

In the Metallurgical Department a new electrically-driven rolling mill has been put to work, and in connection with this a 1,000-ampere-hour 120-cell Tudor battery and a new motor booster set have been installed in the power house.

THE INVENTIONS BOARD

IN connection with the announcement made early in the month that Lord Fisher had been appointed Chairman of an Inventions Board which has been established to assist the Admiralty in co-ordinating and encouraging scientific effort in its application to the requirements of the Naval Service, it is now stated that the organisation of the Board has been completed. It will comprise a Central Committee and a Panel of Consultants consisting of scientific experts, who will advise the Central Committee on any matters referred to them.

The Central Committee will consist of Lord Fisher, Sir J. J. Thomson, F.R.S., the Hon. Sir C. A. Parsons, F.R.S., and Dr. G. T. Beilby, F.R.S.

The consulting panel will consist of the following, which, however, may be added to from time to time as events may prove necessary:—

Professor H. B. Baker, F.R.S. (Professor of Chemistry, Imperial College), Professor W. G. Bragg, F.R.S. (Professor of Physics, Leeds University), Professor H. C. H. Carpenter (Professor of Metallurgy, Imperial College), Sir William Crookes, O.M., F.R.S., W. Duddell, Esq., F.R.S., Professor Percy Frankland, F.R.S. (Professor of Chemistry, Birmingham University), Professor Betram Hopkinson, F.R.S., Sir Oliver Lodge, F.R.S., Professor W. J. Pope, F.R.S. (Professor of Chemistry, Cambridge), Sir Ernest Rutherford, F.R.S., G. Gerald Stoney, Esq., F.R.S., Professor the Hon. R. J. Strutt, F.R.S. (Professor of Physics, Imperial College).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

Among the examination results in the Faculty of Engineering at the University of Bristol the following relate to the electrical engineering final examination for the certificate:—(Pass) R. J. Perry. Final examination for B.Sc. second-class honours, S. Bartlett; pass, E. G. Moody and L. G. H. Sarsfield.

The full four-year course in electrical engineering at the University of Birmingham, which qualifies for the degree of B.Sc., will commence as usual in the autumn, the session opening on October 5th. The electrical engineering department is under Professor G. Kapp, who is assisted by Messrs. E. J. Kipps and T. F. Wall as lecturers. The Principal of the University is Sir Oliver Lodge, F.R.S. Full particulars of the courses can be obtained from the Secretary.

The complete courses of instruction provided at the City and Guilds (Engineering) College, South Kensington, which forms the engineering section of the Imperial College of Science and Technology, lead up to and include the highest specialised instruction for students, with the object of fitting them to take leading positions as electrical engineers, investigators, advisers, and experts, and those qualified who desire to take up more advanced courses of training and research in connection with those branches in which they are specially interested. The department of electrical engineering is under the direction of Prof. T. Mather, F.R.S., and that of mechanical engineering and motive power is under Prof. W. E. Dalby, F.R.S. Further information may be obtained from the Registrar.

Half-watt Lamps for Street Lighting in New York.—According to the *Electrical World*, during the last six months upwards of 10,000 arc lamps have been replaced by an equal number of half-watt lamps of various sizes from 300 to 1,000 watts. While this substitution was made on a lamp-for-lamp basis, the size in each case was determined by the illumination demands of the immediate vicinity, as follows: Large squares at intersecting streets and junction points, 750-watt lamps; important thoroughfares, 500-watt lamps; crosstown thoroughfares, tree-lined or parked avenues, and streets and avenues with car lines, 400-watt lamps; mercantile and wholesale districts, residence streets and small parks, 300-watt lamps. Approximately 600 multiple-arc lamps in use on the bridges connecting the several boroughs have also been replaced by 300-watt gas-filled tungsten lamps. These lamps are divided between those of the bowl-frosted type, installed with socket housings having an elongated neck reflector coming well down over the neck of the lamp and without the usual globe inclosure, and those in standard housings. The lamps without inclosing globes are of the straightsided, pear-shaped type, and have withstood local climatic conditions and traffic vibrations satisfactorily.

COAL SUPPLIES

THE Board of Trade introduced a Bill into Parliament on Wednesday last week limiting the price of coal. Briefly, it provides that the price at the pit-mouth shall not be more than four shillings per ton in excess of the price obtaining twelve months ago. In special circumstances the Board of Trade may increase this difference where the conditions warrant it. The Bill, however, does not apply to contracts already made.

This point has been a matter of some discussion, and opinions are held that the Bill, which passed its second reading in the House of Commons on Monday, is to a large extent useless for the purpose of keeping down prices during the coming winter, inasmuch as most contracts have already been entered into. The case for the Bill, however, is that in the absence of such a measure there would have been the likelihood of much higher prices being charged than last winter. On the whole, therefore, it would seem that electricity supply undertakings need not anticipate any appreciable reduction in their coal costs in the near future. The Board of Trade admits that the task of dealing with existing contracts would be much too complicated, but London merchants, at any rate, have agreed with the Government not to charge higher prices than are necessitated by the extra costs, and have placed their books at the disposal of the Board of Trade. This confirms the general view of London electricity undertakings which deal through merchants, viz., that throughout last winter the merchants did their utmost to act up to their pre-war contracts, and at the conference held at the Institution of Electrical Engineers several speakers mentioned this fact.

It is possible that when the Bill is considered in Committee some amendments will be made. It is significant that Sir Arthur Markham, a colliery owner, should protest against a standard increase of 4s. per ton. He suggests that 2s. would be nearer the extra cost to which colliery owners have been put. On the other hand, other colliery owners during the course of the second reading debate protested against the coal industry being singled out for treatment in this way, but a motion for the rejection of the Bill was withdrawn.

MUNICIPAL WIRING POWERS

THE reference on page 302 of our last issue to the fact that the "Model" Wiring Clause had been inserted in the Plymouth Corporation Bill by the Lord Chairman of Committees after a House of Lords Committee had granted the Corporation powers to wire without the intervention of a contractor, may perhaps need a little further explanation as to the meaning of the "Model" Clause. The authorities of Parliament who deal with private Bill legislation have a set of "Model" clauses capable of application to electric supply, railways, tramways, &c., which are added to and modified from time to time. These clauses relate to matters usually of a non-controversial nature, and represent for the time being the settled policy of Parliament with regard to these details. Consequently any promoter coming to Parliament for powers covered by these clauses has to show a very special case before any deviation from them will be allowed by those whose duty it is to scrutinise the Bills before they reach Committees of either House. This, of course, does not take away the right of the Committee to grant such powers as it thinks fit, but, as in the Plymouth case, alterations can be made even after a Committee has given its decision in favour of a modification of the "Model" Clause.

The position with regard to the "Model" Wiring Clause is that, before the introduction of the first I.M.E.A. Bill, a clause was introduced into the set of "Model" clauses stipulating that where a municipal undertaking takes powers to wire and fit consumers' premises the work must be placed in the hands of a contractor. This has been the uniform practice since that date, and, of course, the strong opposition to the I.M.E.A. Bill has been due to the fact that this latter would modify the present "Model" Clause. If the I.M.E.A. Bill had been passed, the "Model" Clause would have been altered accordingly. As pointed out on page 127 of our issue for March 5th, however, the latest I.M.E.A. Bill differs in many respects from its predecessors, for it concedes to the contractors the point that all wiring work shall be sub-let to a contractor where there is more than one electrical contractor in the district, giving to municipalities, however, the powers to hire and sell electric lighting and heating apparatus with due protection to the contractors from any under-selling. But this, as our readers know, does not meet with the approval of the contractors except in Scotland. Still, it is obvious that

at the present time no good purpose would be served in introducing the I.M.E.A. Bill into Parliament even if an opportunity could be found.

THE OSRAM v. POPE PATENT ACTION

Judgment for Pope Co.

M R. JUSTICE JOYCE gave judgment on Tuesday in the action by the Osram Lamp Works, Ltd., for alleged infringement by Pope's Electric Lamp Co. of the Just and Hanaman patent No. 23,899 of 1904. The proceedings in the case were reported in our issues for July 1st, p. 283; July 8th, p. 294; and July 15th, p. 304. Premising his remarks by stating he had received the hint that the case would go to the House of Lords on appeal, Mr. Justice Joyce read the following passage from the specification as constituting the material part of it for the purposes of the action and as representing the process described by the patentees :—

For the manufacture of filaments of this kind finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide as mixed with an organic binding medium, such as collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide or the like, from which mass filaments are formed in the usual manner, and are then carbonised, in some instances after denitration has previously been effected. The filaments so produced and consisting of tungsten and carbon are then submitted to the following further treatment.

First of all the carbon, which has only served as a binding medium, is removed by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen, and thus raising it to a high temperature. By this process the carbon is completely oxidised so as to form carbonic oxide and a filament of tungsten is left. These filaments are then rendered uniform in a manner similar to that employed in the treatment of the usual carbon filaments, by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen whereby the tungsten deposited equalises the filaments. The filaments which have been rendered uniform in this way are then sealed in glass bulbs in the usual manner, and these latter are exhausted.

It appeared from the evidence, continued his Lordship, that the usual manner of forming filaments referred to in the above extract from the specification was to make the materials into what was termed a compound having the consistency of thick treacle, which was then squirted through a glass nozzle. The defendants, however, made a much thicker paste. Then there was the question of carbonisation. The specification carried this out in the usual manner, and there was some dispute as to whether defendants carried out their carbonisation in the usual manner. It was denied with some show of reason that the defendants did so. He had some doubt whether they did so or not, but as to whether the defendants used the series of processes described in the patent, or, indeed, any of them, he did not feel much doubt. Rightly or wrongly, he did not think they used any one of them. They certainly did not pass a current through the filament, and the filaments were not subjected to the passage of current in an atmosphere of steam and hydrogen. In his opinion the defendants did not use an atmosphere of steam and hydrogen in the sense in which the phrase was used in the specification or was intended by the patentees; nor, indeed, did the defendants use steam at all in the ordinary sense of the word. He understood steam to be water-vapour. The dictionary he had consulted described steam as "the hot vapour given off at boiling point," although it was added that true steam was invisible, the white cloud termed steam being a collection of fine drops of water formed by condensation. The hydrogen used by the defendants was dry, but it was said by the plaintiffs that an infinitesimal amount of water-vapour was formed during the process which constituted steam in the scientific sense. That might be so, but it was certainly not subjecting the filaments to the passage of a current in an atmosphere of steam and hydrogen, as described or indicated in the patent. Nor was the defendants' process an equivalent process. In the circumstances, seeing how many of the steps described in the specification were omitted from the method adopted by the defendants, and alleged to constitute infringement, he was unable to bring himself to the conclusion that the patent had been infringed by the defendants. He therefore held that the patent had not been infringed, and the action must be dismissed with the usual costs.

As to the validity of the patent, had it been necessary for him to go into this, he would have had serious doubts on the matter, not only as to subject matter, but as to the sufficiency of the instructions given by the patentees.

It was intimated that the Osram Lamp Works, Ltd., will give notice of appeal immediately.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,452.

Below are two diagrams of a three-phase star delta starting-switch showing contacts made when in the starting and running positions. Please show connections to motor terminals and mains. In Fig. 2 numbers 1 and 4 terminals are the ends of one circuit as tested by a lamp, also numbers 2 and 5, 3 and 6, two other circuits. The terminals of another motor are lettered

Fig.1.

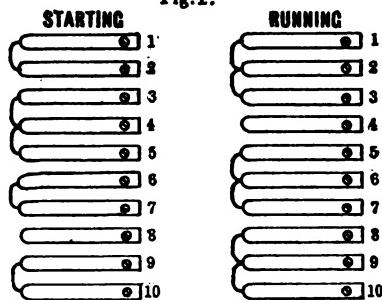


Fig.2.

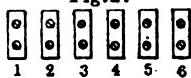
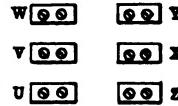


Fig.3.



as in sketch 3. As received from the makers, the terminals marked X Y Z are short-circuited. Could this motor be coupled to a star delta starting-switch? Why is the lettering of the two top terminals on the right reversed? W and Y are not the ends of one circuit, as there are 13 megohms between them. Give a diagram showing the connection of the terminals to motor windings.

(Replies must be received not later than first post, Thursday, July 30th.)

ANSWERS TO No. 1,450.

I am in charge of the electrical plant at a large works. The current is supplied to us through a 1,200-kw. 6,000-500-volt three-phase transformer, and drives a large number of induction motors. The star-point of the transformer is not earthed. I have tested all motors and feeders to earth with the megger, and I get a good test; but when I put the current on, I get a faint glow on two 220-volt lamps connected in series from all three phases to earth. I afterwards placed one 220-volt lamp across each phase to earth, but I only got the same faint glow. I then switched the current off the transformer, and I tested

the low-tension side of transformer when in circuit with ten feeders and distribution-boxes up to the motor switches. I got a test of 600,000 ohms on all phases to earth. The current was then switched on the feeders, but I still get the same faint glow on the lamps as before. The question is: Why do I get a glow on the lamps, and why only the same glow on the single lamp? If there is leakage to earth there must be a short on at least two phases through earth, but I have no fuses blown.—"PELICAN."

The first award (10s.) is made to "H. H. H." for the following reply:—

The reason "Pelican" is able to obtain a faint glow on his testing lamps is due entirely to the effects of capacity current on his system. Any system of insulated conductors acts as a condenser, in which certain conductors act as one plate of the condenser, and other conductors and earth act as the other plate. On connecting the lamp or lamps to any phase and earth, capacity currents of the other phases will charge and discharge through the lamps. The reason the single lamp allows only the same as the two in series is explained by the fact that the vectorial sum of two quantities in quadrature when one is much smaller than the other is very slightly greater than the greater of the two quantities. In the case under consideration we have the lamp resistance in series with the capacity admittance or reactance, and assuming each lamp has a resistance when glowing of 800 ohms and the capacity reactance is 4,000 ohms, the impedance = $\sqrt{4,000^2 + 800^2} = 4,080$ ohms. When two lamps are used, and assuming the total lamp resistance is 1,600 ohms, the total impedance is = $\sqrt{4,000^2 + 1,600^2} = 4,308$ ohms. In the first case the current flowing through the lamp is 0.122 amp., and in the second case the current is 0.114, a difference of only about 7 per cent.

The second award (5s.) is given to "E. H.," who writes as follows:—

The tests referred to in the question are quite sufficient to show that the insulation of the system is quite satisfactory, and that the glow of the lamps is not due to a fault. The only other cause that could produce the phenomena noticed is the condenser action between the system and earth: the transformer and motor windings are wound on iron cores, which are most probably well earthed; the feeders, especially if underground, also have some capacity. Suppose the lamps employed for testing had carbon filaments and absorbed, say, 60 watts each at their rated voltage. Now filament lamps glow with about half their normal voltage, so that the corresponding current would be $\frac{1}{2} \times \frac{60}{220} = 0.136$ amp. (neglecting change in resistance). Also, resistance of one lamp = $\frac{220}{0.272} = 810$ ohms. The capacity of the transformers and motors is distributed over the three phases. Suppose that Z be the reactance, which when connected across 500 volts gives the same current as that produced by the actual capacity of the three-phase system in question. Then with two lamps connected to earth

$$I = \frac{E}{\sqrt{R^2 + Z^2}}$$

$$\therefore 0.136 = \frac{500}{\sqrt{(1620)^2 + Z^2}}$$

$$\therefore Z = 3300$$

When there is only one lamp connected between the line and earth, we have

$$I = \frac{500}{\sqrt{(810)^2 + (3300)^2}} = 0.147.$$

That is, inserting one lamp instead of two between the line and earth only increases the current from 0.136 to 0.147 ampere, so that the single lamp would no more than glow. If the current through the lamps is less than half the normal value (as indeed is probably the case, since the glow is "faint"), the increase in current obtained by removing one lamp is less than that given above. It may be mentioned that any harmonics present either in the phase or in the line voltages would assist in accentuating this phenomenon.

ANSWER TO CORRESPONDENT

E. H. G. (Natal).—The Managing Director of the National Electric Construction Co. is Mr. W. B. Cownie. The address is 3 Laurence Pountney Hill, E.C.

AN INDIVIDUAL DRIVEN DOUBLING FRAME INSTALLATION

PREPARED TO laying down their new doubling frame installation at their new Arden Works, King Cross, Halifax, Messrs. S. Thornton & Co., Ltd. fully investigated the different systems of drive available, and after a brief examination of the factors involved electricity was selected, one of the determining factors being that electric power is supplied by the Halifax Corporation at a comparatively low rate, especially when the mill runs at

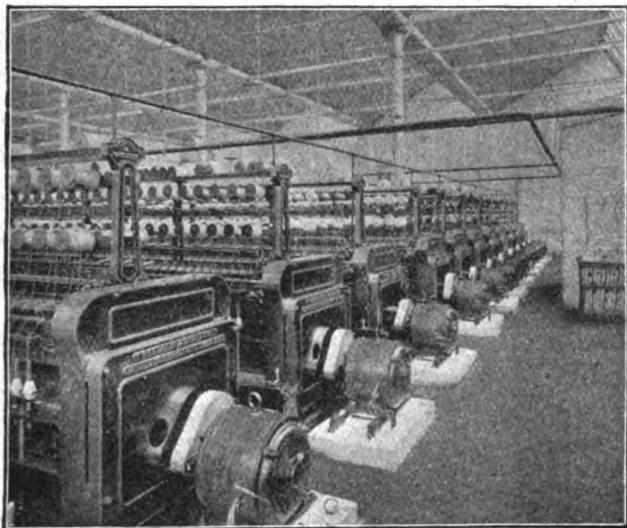


FIG. 1.—A VIEW OF 7 H.P. "WITTON" MOTORS DRIVING THE DOUBLING FRAMES.

night time. On the advice of their consulting engineer and also of the Textile Department of the General Electric Co., Ltd., individual drive was installed. The installation aggregates about 100 h.p., and the machines comprised in this installation are:—Twelve ring-doubling frames of 300 spindles, eight power reels, four 60-drum winding frames, 120 bobbins each, one 120-drum winding frame, one bundling press, one preparing machine.

The Halifax Corporation has installed in the mill a 100-kw. three-phase 6,600-volt 50-cycle transformer, to reduce the

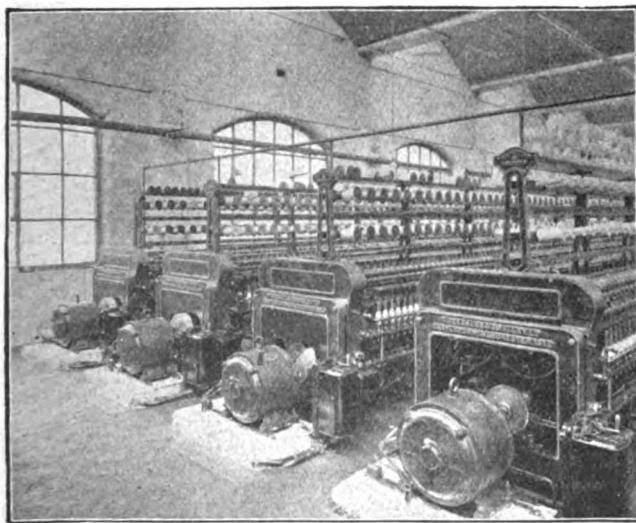


FIG. 2.—DETAILED VIEW OF THE MOTORS AND STARTING SWITCH-GEAR, SHOWING COVERS REMOVED FROM THE GEARS.

supply pressure to 220 volts, as this is the most suitable for small individual drive motors. The electrical equipment was entrusted to the Textile Department of the General Electric Co., Ltd. (of Wellington Street, Leeds, and 67 Queen Victoria Street, London, E.C.).

The problems involved in the individual driving of the doubling frames required close attention. Usually the tin roller shafts on doubling frames are run at a speed of from 800 to 1,000 r.p.m., but in this case the frame-makers required a speed not exceeding 880 to 900 r.p.m. As the nearest motor speed on a 50-cycle supply was between 960

and 970 r.p.m., direct coupling was out of the question. In consequence, it was decided to use 7-h.p. "Witton" squirrel-cage protected type textile motors with ball bearings, running at a speed of 1,450 r.p.m., the motors being fitted with machine-cut double helical gear, made by the Power Plant Co., Ltd. The larger gear wheel is keyed directly to the frame shaft. The power at 220 volts is distributed to the machines from a compactly designed "Witton" switchboard, enclosed in a sheet-iron case, the cables being carried underground in conduit to a point close to the motors. The motors are started by means of ironclad starters, a set of fuses, also in a cast-iron case, being included in the motor circuit, when the starter is in the running position. A general view of the twelve "Witton" motors driving the doubling frames is shown in Fig. 1, and a more detailed view of the motors and switchgear in Fig. 2.

Although this installation is on a small scale, it has thoroughly proved the claims made for the individual electric drive. It has shown, *inter alia*, that the individual drive effects a considerable saving in power and space as well as in the cost of the buildings. The absence of belting and shafting has permitted the buildings to be of a lightly constructed type, and at the same time the illumination is very good. Electric driving has also resulted in an increased and improved production. The machines run with great steadiness, and at the same time maintenance is reduced to a minimum, and the ability to run individual machines on overtime without keeping an engine-room staff at work is a very great convenience.

The buildings are lighted throughout by Osram Axial type lamps, with an obscured reflector fitting close to the lamp. The lights are arranged down the doubling frames. The installation has now been running nearly a year, and although there is naturally considerable vibration, only one lamp has been broken, and that through being dropped on the floor.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

A Paper on the use of unbroken alternating current for cable telegraphy by Lt.-Col. G. O. Squier was read at a recent meeting of the Physical Society. The Paper proposes a new point of view in the method of transmission of signals in the submarine telegraph cable, and describes some apparatus for operating on the general principles involved. An ocean cable is considered as a power line, and starting with the standard form of circuit which would be used in case it were required to operate an electric motor through an ocean cable, experiments are described to determine the minimum possible variations required in such a circuit to permit the alternating current received to be interpreted in dots, dashes, and spaces of the present alphabet. The uninterrupted alternating current used in transmission is operated on synchronously by the ordinary transmitting tape, so as to alter the impedance of the transmitting circuit at the instants when the current is naturally zero. Dots, dashes, and spaces are each sent by semi-waves of either sign, but of different amplitudes. The alternating current received may be read directly from the record made by a siphon recorder, or this current may be employed to operate a siphon Morse printer, by means of an adaptation of Muirhead's gold-wire relay, or a Heartley magnifier and a local wire relay. The voltage stress along an Atlantic cable when an alternator is employed is shown, and the transmitting impedance of such a cable is computed as the frequency varies. A special form of cable dynamo to operate at frequencies from 4 to 10 was used in the experiments described. The fundamental principle is developed of never metallically "breaking" the transmitter circuit, which permits of greater accuracy in balancing the duplex bridge.

The directors of Marconi's Wireless Telegraph Co. recommend a dividend of 10 per cent. on the ordinary shares and 7 per cent. on the preference shares for the year ended December 31st, 1914. These compare with dividends of 20 per cent. and 17 per cent. respectively in the previous twelve months, and in view of conditions generally and the amount of work which the Company has had to do on behalf of the Government (in respect of which no account is taken in this balance sheet) it is not felt that the result is really so unsatisfactory as the diminution in dividends might at first sight suggest. The net profit for the year was £232,700, which represents an increase of £110,892 over the previous year. A very much smaller amount, however, was carried forward from the previous twelve months, and the available surplus was only £40,000 higher than in 1913, after transferring £100,000 to reserve.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is, Strictly Copyright.)

Specifications Published July 15th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad

24,029/13. Metal Filament Lamps. C. GLADITZ. Metal filament lamps with an inner bulb containing ammonia gas and an outer bulb forming a vacuum jacket acting as a heat insulator and preventing the outer glass from becoming porous. (Three figures.)

7,682/14. Metal Filament Lamps. B.T.-H. Co. (G.E. Co., U.S.A.). Gas-filled tungsten lamps in which an electrically-charged screen of wire netting is provided near the filament in a position to intercept the convection currents of gas before they reach the bulb, and to arrest the tungsten particles driven off from the filament before they can blacken the bulb. (One figure.)

7,779/14. Commutators. SIEMENS BROS. DYN. Wks., LTD., C. P. BRAMLEY, and T. A. WISDOM. A commutator in which the end faces of the bars are recessed and filled in flush with non-shrinking insulating material with the object of lessening the liability to breakdown between the end ring and the surface. (Four figures.)

8,385/14. Starting Rotary Converters. E. ROSENBERG. An arrangement for starting a rotary converter provided with a booster, comprising extra windings or tappings from the transformer supplying the converter and switches by which a voltage less than the full voltage can be applied to the armature of the booster to cause it to start up as a motor. When the desired speed has been attained, the full voltage is applied to the converter armature through the booster armature. (Two figures.)

14,984/14. Electric Railway System. C. E. H. HOBBHOUSE, W. SLINGO, H. C. GUNTON, and C. H. DOUGLAS. An improved electric railway system partly worked by remote control and partly automatically in which the conductor rail supplying the train motor armatures is divided into insulated sections and the potential applied to the train motors is controlled by an automatically-effected adjustment of the rheostat in the field circuit of the generator supplying that section. (One figure.)

15,489/14. Locking Lampholder. F. JONES. A locking lampholder for lamps with special caps, having a recess in the holder and flat spring in the cap (or vice versa) to co-operate with the recess by engaging with it to lock the lamp in, and to take the thrust of the contact plugs. A covered key channel is formed between the lamp and the holder by which a special tool may be inserted to deflect the spring when the lamp is to be removed. (Five figures.)

21,435/14. Metal Filament Lamps. B.T.-H. Co. (G.E. Co., U.S.A.). Gas-filled or other focus lamps with the filament in the form of two concentric helices, the outer one of which may be of greater resistance per unit length than the inner one, and may be coiled more loosely. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: PLANIWERKE A.G. FÜR KOHLENFABRIKATION [Arc lamps] 15,485/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MENZEL [Insulating tubes] 25,362/13; ARNO [Distribution systems] 3,280/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Motor control] 12,941/14; MICANITE & INSULATORS Co. and ALLAN [Insulating materials] 16,027/14; WOODHOUSE and CALLENDER'S CABLE & CONSTRUCTION Co. [Terminal boxes] 18,761/14.

Dynamos, Motors and Transformers: ROUTIN [Motor control] 683/14; J. STONE & Co. and DARKER [Dynamos] 7,589/14 and 7,590/14; KOCSIS and LÜCÖ [Driving dynamos] 23,686/14.

Heating and Cooking: FRANK [Radiators] 24,827/13; GOOD and WOODHOUSE [Heating elements] 19,484/14.

Ignition: CONNER [Magneto] 20,330/14; KETTERING and CHRYSST [Ignition system] 7,813/15.

Incandescent Lamps: KNIGHT and CLERK [Incandescent lamps] 16,007/14.

Instruments and Meters: WAHN [Fault localiser] 25,701/13; A.E.G. [Regulation of phase displacement in induction meters] 3,912/14; DRANSFIELD [A.C. voltmeters] 5,676/14.

Switchgear, Fuses and Fittings: SIEMENS BROS. DYN. Wks.,

KOETTGEN, and BOLTON [Switchgear] 25,072/13; WADE (Kaisser) [Switches] 313/14; GREEN [Switchboards] 953/14; DRESLA [Time switches] 8,504/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Circuit controlling devices] 16,327/14; RAILING and GARRARD [Relays] 16,575/14; COLLIE [Lampholders] 20,580/14; BURDON (Siemens & Halske A.G.) [Relays] 21,936/14; REASON [Switch and fuse boxes] 945/15.

Telephony and Telegraphy: SIEMENS & HALSKE A.G. [Telephone circuits] 1,871/14; SYKES [Relays for wireless telephony] 7,922/14; DRUMAUX [Telephone relay] 8,794/14; KUHR and BRIDGES [Wave detector] 9,686/14; OGILVIE and CREED, BILLE & Co. [Telegraphy] 11,222/14; HART [Transmission of pictures of moving objects] 15,270/14; AUTOMATIC TELEPHONE MANUFACTURING CO. (Automatic Electric Co., U.S.A.) [Telephone systems] 15,338/14; WHITE and PARSONS [Intercommunication telephones] 15,727/14; GALLETTI and GALLETTI'S WIRELESS TELEGRAPH & TELEPHONE CO. [Wireless receiver apparatus] 16,380/14; STERLING TELEPHONE & ELECTRIC CO. and BELL (Telephon Fabrik A.G.) [Call apparatus] 16,424/14; BLOXAM (Telepantograph Ges.) [Telautographs] 17,399/14.

Traction: SIEMENS SCHUCKERTWERKE [Cooling of electric locomotives] 25,479/13; GILL (U.S. Lighting & Heating Co.) [Train lighting] 10,253/14; KETTERING and CHRYSST [Engine starters] 7,013/15.

Miscellaneous: EDISON [Illuminating devices] 24,711/13; MASCHINENBAU ANSTALT HUMBOLDT [Magnetic separators] 3,986/14; A.E.G. [Electric soldering] 16,126/14; THOMPSON and DAVIES [Magnetic separators] 19,254/14; LUCAS and EDWARDS [Connections] 19,344/14; MELLERSH-JACKSON (Commonwealth Electric Tool Co.) [Electrically-actuated tools] 23,884/14; CONRAD [Starting mercury vapour apparatus] 1,468/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrochemistry: BUCHER [Electrical production of cyanides] 23,292/14.

Telephony and Telegraphy: TURNER [Telephone systems] 6,480/15.

Traction: KETTERING & ANR. [Engine starters] 7,757/15.

Miscellaneous: GIRAUD [Electric rivet heaters] 8,449/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: H. H. LAKE (W. G. Clark) [Insulators] 7,651/07.

Dynamos, Motors, and Transformers: J. Y. JOHNSON (Felten & Guilleaume Lahmeyerwerke A.G.) [Regulating field windings] 7,920/06; B.T.-H. Co. (G.E. Co., U.S.A.) [Prevention of sparking in single-phase motors] 6,959, 6,960, 6,961, and 6,963/08.

Storage Batteries: T. A. EDISON [Nickel-cobalt composition for alkaline storage battery plates] 1,925/06.

Switchgear, Fuses, and Fittings: C. H. DAVIES [Tumbler switches] 7,377/03.

Telephony and Telegraphy: V. POULSEN and P. O. PEDERSEN [Improvements in telephones] 7,292/03; J. SCHIESSSLER [Wireless telephony] 4,027/09.

Traction: A.E.G. [Tramcar current recorders] 6,527/07.

Miscellaneous: H. H. LAKE (G. Pino) [Submarine illumination, &c.] 7,365/03; R. M. LOWNE and LOWNE ELECTRIC CLOCK & APPLIANCES CO. [Electric clocks] 6,690/05.

The Accurate Measurement of Resistance.—At a recent meeting of the Physical Society a Paper was read by Mr. E. H. Rayner describing methods by which the comparison of resistances can be made to an accuracy of 1 in 10,000 or higher by using simple apparatus usually available in electrical laboratories, or which can be easily constructed with little skilled assistance. The comparison of nominally equal resistances of 1 ohm and upwards by the usual method of shunting one side of a nearly balanced quadrilateral by a high resistance was mentioned. Variations on this when only part of one resistance is shunted were often useful. The advantages of having resistances capable of carrying comparatively large currents were illustrated, especially for measuring changes of resistance of commercial apparatus under working conditions. The determination of errors in a volt box for use with a potentiometer was described at some length. If a sufficient continuous-current voltage was not available for testing such apparatus as high-potential dividers, it was shown that using sufficient continuous current to secure sensitivity the heating might be supplied by superposed alternating current. Resistances in common use were generally of simple numerical value, and a Kelvin bridge specially designed for the comparison of such resistances consisting essentially of two rows of 25 resistances and 20 ohms each were described.

ELECTRIC TRACTION NOTES

The annual general meeting of the Tramways & Light Railways Association was compressed this year into half a day in London, instead of the usual three days in the provinces. The programme contained three Papers, none of which, however, evoked very considerable discussion, and we therefore confine our notes on the proceedings to a brief reference to the one or two features which assumed most importance during the meeting. In the first place, the Council has had under consideration the very serious position in which tramway undertakings are finding themselves in regard to obtaining supplies of materials such as car wheels, axles, tyres, &c. The matter was referred to in a Paper by Mr. J. W. Dugdale, General Manager and Engineer of the Oldham Corporation Tramways, who mentioned the necessity for placing orders for tramcar tyres at prices 50 per cent. higher than those paid twelve months ago, and at the same time having to wait months for delivery. Mr. Dugdale suggested the appointment of a Purchasing Committee, which would deal with the question of obtaining supplies for all tramway undertakings, at any rate during the war. The Council have passed a resolution asking the Minister of Munitions to receive a deputation on the matter at an early date. Another matter which is exercising the managements of tramway undertakings, and which, in some managers' view, is even more important than obtaining supplies, is the gradual shrinkage in the labour available. Many tramway managers foreshadow serious curtailment of services and the probable stoppage of some routes altogether, unless something is done which will leave their employees free from further recruiting. So far as the technical staffs in the power stations and substations are concerned, the men employed by the Metropolitan Tramways, Ltd., and the London United Tramways, Ltd., have been allowed to enrol as munition makers, and their application forms are stamped "Public Utility Service," and the Minister of Munitions has expressed the opinion that such men are considered as much serving their country as if they were actually in a factory. No doubt this principle will be applied to all tramway undertakings. The difficulty, however, with the motormen and conductors is that even tramway managers cannot force themselves to the view that these can be regarded by any stretch of imagination as munition workers, although the Government has given instruction that tramway services for conveying munition workers to and from their work are to be maintained at all costs, and, where necessary, both day and night.

Another Paper read at the meeting was by Mr. A. V. Mason, General Manager of the South Metropolitan Electric Tramways & Lighting Co., which had the title "Glimpses into the Obvious," and dealt with a large number of minute details connected with tramway management, apart from the engineering aspect, which we do not propose to traverse here. He gave a list of thirty "bread-and-butter" tips, which no doubt will be read with interest by tramway managers, but they have no reference to engineering matters, notwithstanding their admitted importance to the proper conduct of a tramway undertaking.

The final Paper was by Mr. W. H. L. Watson, of Edison Accumulators, Ltd., and dealt with "Electric Battery Vehicles as Adjuncts to Tramways." In the main it added little to our knowledge of the use of battery vehicles, as it was discussed at the annual meeting of the I.M.E.A. about a month ago (ELECTRICAL ENGINEERING, June 24th, p. 273). Reference was, of course, made to the South Shields and York buses, and similar vehicles are now running at West Ham and Loughborough, but experience is too short to draw any conclusions. Another direction in connection with tramways in which battery vehicles are now being used is for tower waggons for the repair of overhead lines, and Ilford, Derby, and Belfast have testified to their satisfactory working. The same complaints were made in the brief discussion which followed the Paper as were made at the I.M.E.A. meeting, and also at the Institution of Municipal and County Engineers' annual meeting more recently, as to the high cost of all forms of battery-driven vehicles and their slow speeds. It was remarked, as a curiosity, that whereas a battery vehicle is able to maintain a high speed on a short, sharp hill, it is painfully slow on long gradients less severe. In this connection Mr. Watson mentioned that experiments have been carried out with a change-speed mechanism, but so far they have not been successful. At the same time, the real object of these experiments was not so much to increase the speed as to secure a lower current consumption on the hills.

ELECTRIC POWER IN A BAKERY

A MODERN bakery can only afford to employ the most efficient methods, and this has been recognised in the recent installation of electric drive in the Plantation Bakery of Messrs. J. and B. Stevenson in Glasgow. This firm had previously equipped their Cranstonhill Bakery with B.T.-H. electric motors (see ELECTRICAL ENGINEERING, Vol. X., p. 196, April 2nd, p. 197), and so successful were the results from this electrification that they determined to equip their Plantation Bakery in the same way. Power is obtained from the Glasgow Corporation. The firm has found that with the electric drive they have an increased output of superior quality, together with greater cleanliness and economy. No-



FIG. 1.—PIPE-VENTILATED MOTOR DRIVING AUTOMATIC MOULDING PLANT WITH AN OUTPUT OF 2,400 LOAVES PER HOUR.

where is a clean form of power more requisite than in a bakery, and electricity supplies the cleanest form of power possible. It is also important to remember, in this class of work, that with electric motors the expense for current is proportional to the work done, for while standing idle the motor does not consume any current, and when running consumes only sufficient current to do the work, and as it is as simple a matter to start or stop the motor as it is to turn the electric light off or on, there is no inducement to allow the motor to run idly, but to employ all the current usefully.

Fig. 1 shows a 12-h.p. B.T.-H. pipe-ventilated motor driving automatic moulding plant, comprising divider, hander-up, automatic prover, and Scotch moulding machine, having an output of 2,400 2-lb. loaves per hour. Fig. 2 shows a 25-h.p. B.T.-H. pipe-ventilated motor driving two kneading machines, automatic flour-sifters and weighing machines, comprising a three-sack installation. There is

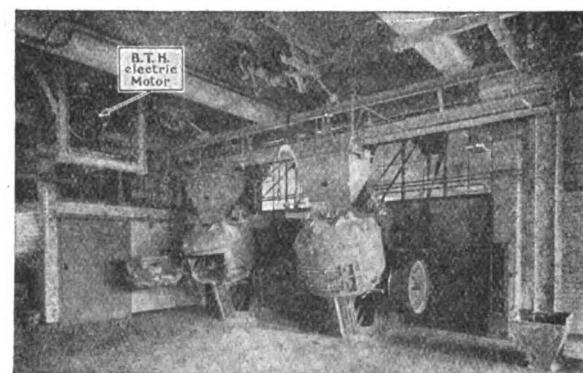
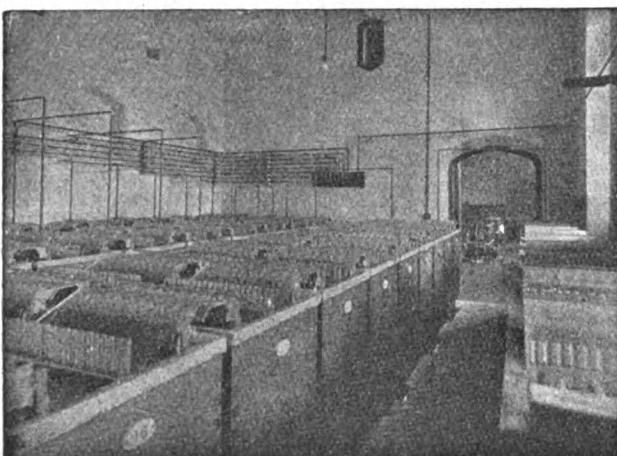


FIG. 2.—KNEADING MACHINE, FLOUR SIFTERS, AND WEIGHING MACHINE DRIVEN BY PIPE-VENTILATED MOTOR.

also an 18-h.p. pipe-ventilated motor driving stirring machine, flour-sifter, and automatic weighing machine. This use of pipe-ventilated motors is a special feature; they draw in air from the outside of the building, thereby avoiding the motors being clogged by working in a dust-laden atmosphere. We understand that the installation has proved thoroughly successful, so much so that repeat orders have been placed for electric motors. Attention should be called to the way in which limitations of space are met by suspending the larger motors from steel framework from the roof, thereby leaving the floor space entirely clear for production. The British Thomson-Houston Co., Ltd. (Rugby) supplied the motors for the above interesting installation, and other examples of motors supplied by them for driving bakers' machinery are found at Cranstonhill Bakery, and the Scottish Wholesale Co-operative Baking Society's Dalziel Bakery in Motherwell.

TUDOR ACCUMULATORS FOR COUNTRY-HOUSE LIGHTING



STONELEIGH ABBEY, KENILWORTH.

Battery of 56 cells, 1940 ampere-hours.
(Plant supplied by Midland Electric Light & Power Co., Ltd.)

SMALL BATTERIES from 35 AMP.-HOURS UPWARDS.

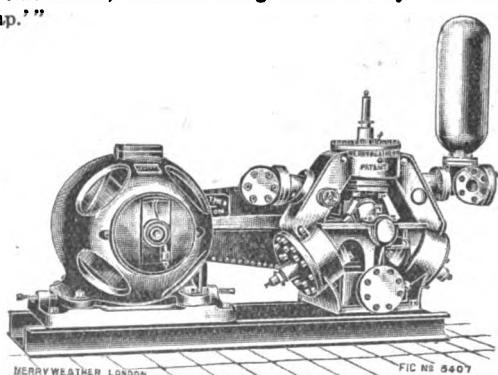
ASK FOR PRICE LIST of COMPLETE BATTERIES for
25, 50 and 100-volt INSTALLATIONS.

TUDOR ACCUMULATOR CO., Ltd.,
3, Central Buildings, Westminster, London, S.W.
WORKS - DUKINFIELD near MANCHESTER.

THE "HATFIELD" PUMP

Merryweather's Patents.

A Client writes:—"The 'Hatfield' Pumps at this Hotel are particularly successful, especially as regards their silent working. In many hotels one stops at, you can hear the hammer of the pumps vibrating through the whole building, which is very irritating to visitors. Many a comfortable night a man spends in his bed at this Hotel, without being disturbed by 'the thump of the pump.'"



MERRYWEATHER LONDON

FIG NO 5407

THE PERFECT PUMP

FOR

ELECTRIC DRIVING
MANOR WATER SUPPLY
COUNTRY WATERWORKS
SHALLOW WELLS

DEEP WELLS
AUGMENTING PRESSURE IN
FIRE MAINS
FILLING RESERVOIRS, &c., &c.

Write for Illustrated Pamphlet, 193 P.

MERRYWEATHER & SONS
Fire Engine Works, Greenwich, S.E., London.

A NEW ELECTRIC FIRE

A NEW pattern of electric fire, with a special form of built-up bar-heater, has been put on the market under the name of the "Qued" electric fire by Ikin & Eads, Ltd. (47-57 Marylebone Lane, W.), who now carry on the electric heating business started many years ago by Neville, Williams & Co. The construction of the heating element is shown in the figure. The body is composed of a series of special shaped moulded discs of a very carefully chosen quality of fire-clay strung on an iron spindle, clamped tight and prevented from turning by rods slipped through holes from the end. These discs form, when assembled, a core with a series of open slots half-way round, which contain



HEATING ELEMENT OF "QUEAD" FIRE.

the helically-wound nichrome resistance wire which is in a single length zig-zagging round the separating partitions. The wire is thus well supported, although perfectly free to expand. The ends are clamped to substantial terminal plates, and the whole element is simple, strong, and electrically sound. It is run at a bright red heat, and is usually made up in one-kilowatt units, any number of which can be mounted in a single case. We have seen some very artistic and serviceable designs of radiator equipped with these units, and with the whole wire and support glowing together a wonderful radiant effect is produced. These fires, which are remarkably reasonable in price, are to be seen in the firm's showrooms at the address given above.

CATALOGUES, PAMPHLETS, &c., RECEIVED

FANS.—Drake & Gorham, Ltd. (1 Felix Street, Westminster Bridge Road, S.E.), have issued a new list of electric fans of the "Phoenix" type, including desk and bracket fans of the swivel and trunnion pattern for continuous and for alternating current, as well as a small rigid desk fan, oscillating fans, ceiling fans, and porthole and box-blade exhaust fans.

STEAM, WATER, AND AIR-FLOW METERS.—A descriptive list from the British Thomson-Houston Co., Ltd. (Rugby), contains particulars of a series of instruments for the measurement of flow of steam, water, and air in pipes. These act on the principle of the Pitot tube, and employ a plug, with suitable orifices inserted in the pipe by which the velocity head is measured. A number of forms of meter are made, including a dial form direct-reading indicating instrument, as well as recording and integrating patterns. These are actuated by the movements of floats in the mercury contained in a U tube arrangement exposed to the differences of pressure due to the velocity head.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

SWITCHGEAR.—Particulars of a series of designs of A.C. cellular pattern switchboards are contained in a new illustrated leaflet from J. H. Holmes & Co. (Newcastle-on-Tyne). The gear is such that a board of any kind can be built up of self-contained panels with complete interlocking gear and all apparatus in iron cubicles.

POCKET LAMPS.—A folder from Haylock & Haslett (63 Queen Victoria Street, E.C.) gives prices of several patterns of electric torches, and calls special attention to a pocket lamp similar to and little larger than a fountain-pen.

TURBO-GENERATORS.—Two pamphlets from Greenwood & Batley, Ltd. (Albion Works, Armley Road, Leeds), give particulars of generating sets driven by high speed geared turbines of the de Laval type. In one of them a 300-kw. mixed pressure set at the Griff Colliery, near Nuneaton, is described.

THE "INSTALLATION NEWS."—The July issue of this little publication of Simplex Conduits, Ltd. (116 Charing Cross Road, W.C.), contains an article on the illumination of shop windows and of factories, as well as other interesting contributions and notes on Simplex novelties.

"EDISWAN ELECTRIC SERVICE."—The second issue of this magazine of the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), has some interesting news regarding the latest extension of the Ediswan factories and showrooms, and describes some recently introduced pieces of apparatus, fittings, &c.

LEAD COVERING.—A leaflet from Sherard Cowper Coles (1 and 2 Old Pye Street) calls attention to a process of coating iron and steel surfaces with a protective welded-on covering of lead which should result in a surface of great utility for a number of industrial purposes.

STORAGE BATTERIES.—A pamphlet from the Chloride Electrical Storage Co., Ltd. (Clifton Junction, Manchester), gives illustrated particulars of the construction of the "Ironclad Exide" battery, which is extensively used for the propulsion of electric vehicles. The electrodes consist of a number of vertical pencils connected at the top and bottom to horizontal bars. Each vertical pencil contains a core surrounded by the active material, which is in turn enclosed by a hard rubber tube with horizontal slits, allowing of the access of the electrolyte. Ribs are provided to stiffen the tubes and to act as insulating spacers. The low internal resistance enables this form of battery to discharge at very high rates, and excellent records of life have been shown in actual road service.

VACUUM CLEANERS.—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) have issued a new list of electric vacuum cleaners. This includes a powerful portable diaphragm pump machine as well as an apparatus on the bellows principle, and a number of self-contained sets in which the vacuum is produced by a high-speed rotary fan. The lists of accessories for each pattern of machine are very complete, and the list contains all that is required for selecting an outfit to meet any requirements.

METERS.—A catalogue from Thompson & Co. (48 Watling Street, E.C.) gives particulars of several forms of the "Rex" alternating-current induction-type meter of the latest design, which are manufactured in Geneva (Switzerland) by the Société Genevoise pour la construction d'instruments de physique et de mécanique, a firm which has carried on the manufacture of instruments for over sixty years.

BOILER ACCESSORIES.—A leaflet from the National Boiler & General Insurance Co., Ltd. (St. Mary's Parsonage, Manchester), gives particulars of the "National" patent circulator, which is an appliance for preventing external wasting of economiser pipes by raising the temperature of the water entering the economiser by contact with the heated outlet water.

TAR DISTILLING PLANT.—An illustrated pamphlet from the Power Gas Corporation, Ltd. (Stockton-on-Tees), calls attention to a self-contained tar distilling plant such as can deal with tar produced as a by-product from Mond gas producers, &c., to convert the tar into pitch and to recover the oils.

LARGE CAPACITY AUTOMATIC STOKERS

THE 16-retort Erith-Riley Stoker, as built by Erith's Engineering Co., Ltd., 70 Gracechurch Street, London, has the largest capacity of any stoker in use. Four of this size are in use in one plant. Its normal capacity is no less than four tons of coal hourly, and it has 50 per cent. overload capacity. Each stoker is applied to an undivided furnace of a single water-tube boiler, 25 feet wide. The capacity of this stoker is equal to that of a battery of eight large Lancashire boilers, occupying a site 100 feet wide. The use of such large-unit boilers is naturally confined to central electricity stations; but the entirely automatic working of the Erith-Riley Stoker permits unlimited unit capacity. The stoker is of the inclined underfeed type, with the fires kept continually sliced and the ash continuously discharged by reciprocating tuyeres and ash-pushers. The air for combustion is delivered direct to the tuyeres by a suitable fan, and both air and fuel automatically respond to load variations. Each stoker consists of a series of standardised and interchangeable retort-units; four boilers each with 4-retort stoker, or two boilers each with 8-retort stoker, will therefore give identical results to above-mentioned boiler with one 16-retort stoker. For mills, etc., using Lancashire boilers, the Erith stoker is employed, viz., each single-retort unit is applied to each internally-fired furnace; the capacity per retort remains the same, and the combustion is equally smokeless and efficient.

Electric Lighting Provisional Orders.—The Board of Trade had before it last year 31 applications under the Electric Lighting Acts for provisional orders, 20 of which were made by local authorities, and 11 by companies or persons. Of these, 25 were sanctioned, three were rejected, and in three cases the promoters decided not to proceed with the order. In one case only has the opposition been carried into the committee rooms at Westminster, and that is the case of the Southampton Order authorising the Corporation to supply in the parish of Bitterne. In that instance the Southampton Gas Co. asked for the Northumberland Clause, but failed in the House of Commons, and at the moment their opposition in the House of Lords has yet to be heard.

"BILLS"

WE reproduce here an amusing postcard design which has been produced by the Edison & Swan United Electric Light Co., Ltd., Ponders End, Middlesex. This is printed in three colours, and the reverse side is overprinted, leaving



sufficient room for correspondence. We hope that the German "Bills" will be as effectually "kept down" by present events as those of consumers undoubtedly are by the use of these famous drawn-wire lamps.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Ashton-under-Lyne.—Negotiations are in progress with regard to giving a supply in bulk to the Hurst District Council.

Australia.—The Sydney Council requires a two years' supply of A.C. and D.C. motors. Preference will be given to British manufacturers. Tenders to the Town Clerk, Sydney, by Sept. 13th. This information is only of value to firms having agents in the Commonwealth who can be instructed by cable.

Aylesbury.—New cable at an estimated cost of £400 is required.

Barnsley.—The recent application of the Corporation for £21,850 for extensions to plant, mains, &c., has been reduced to £15,000 by the elimination of certain items. At the local inquiry last week the Town Clerk said that the existing plant is totally unable to meet further demands upon it, and in the case of one munitions factory the Department was only able to supply one-quarter of the power required. The extension scheme was abandoned a short time ago on account of the war, but the demands upon the plant now are such that it is imperative the extensions should be carried out.

Bristol.—One 6,000-kw. three-phase turbo-alternator, with condensing plant. Chief Engineer. August 23rd. (See an advertisement on another page.)

Keighley.—Switchgear is required in connection with a new 5,000 kw. turbo-alternator at an estimated cost of £3,225.

London: Bethnal Green.—Having regard to the special circumstances attaching to the Council's electricity supply

scheme, the L.C.C. a short time ago intimated to the Treasury that it should be allowed to proceed. The Treasury has now given the required permission for the borrowing of the necessary sum, viz., £22,450, and of £2,000 for sub-station buildings.

Poplar.—By arrangement with the L.C.C., the Borough Council is taking on loan £8,173 from certain other funds for electrical extensions.

Rotherham.—H.T. cable, trolley wire, and meters. Borough Electrical Engineer, July 24th.

Swinton.—Extensions are to be carried out to the electrical equipment of Matthews & Yates' works.

Wiring

Bradford.—Five houses, Arncilffe Terrace and Woodhead Road. P. T. Cowling, 93 Horton Road.

Treforest.—The arrangement of wiring at Girls' School. Architect, B. J. Day, 8 Park Place, Cardiff.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Portsmouth.—Business premises, King's Road, Southsea. Architect, C. W. Bevis, Elm Grove Chambers, Yarborough Road.

Rhymney.—Isolation Hospital. Clerk.

Swindon.—Sanatorium. County Surveyor, Trowbridge.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Grangemouth.—A contract for a twelvemonths' supply of Tantalum and Wotan lamps has been placed with Siemens Bros.' Dynamo Works.

Heywood.—The following tenders have been accepted:—600 kw. booster, British Westinghouse Co.; reversible battery booster, Phoenix Dynamo Manufacturing Co.; D.C. switchboard, Bertram Thomas; E.H.T. overhead cable, British Insulated & Helsby Cables.

Keighley.—The Electricity Committee recommend the acceptance of a tender by Willans & Robinson for a 5,000 kw. turbo-alternator at £15,875, subject to arrangements being made for deferred payments.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £90 to £91 (last week, £93 to £94).

Advance in Prices.—The Sterling Telephone & Electric Co., Ltd. (210-212 Tottenham Court Road, W.) announce a further 15 per cent. advance, making a total of 25 per cent. increase of their list prices, with the exception of wood bell-pushes, which are only advanced 10 per cent., and certain other prices which are withdrawn.

Bankruptcy.—Herbert Page, trading as Smeeton & Page, Electrical Engineer, 63 Queen Victoria Street, E.C., has been adjudicated bankrupt. The first meeting of creditors is to be held to-day at 11 a.m., at Bankruptcy Buildings, Carey Street, and the public examination is at 11 a.m. on Sept. 7th at the same place.

APPOINTMENTS AND PERSONAL NOTES

Mr. G. G. L. Preece, who for some years has been in charge of the Manchester office of Messrs. Bruce Peebles &



Co., Ltd., has accepted a commission in the Lancashire Fusiliers. During his absence, Mr. E. W. Browne, the Company's representative in Birmingham, will act as manager in Manchester.

Mr. A. J. Howard, Borough Electrical Engineer at Taunton, has been presented with a silver salver by the members and officials of the Town Council on the occasion of his wedding.

Mr. J. B. Sparks has rejoined Dr. Parshall, and is now representing him on important electrical engineering construction work in Spain.

LOCAL NOTES

Carlisle: *Electricity Accounts.*—There was a loss of £76 on the past year's working of the electricity undertaking. The exceptional conditions, however, accounted for this result, as not only were various reductions made in the charges, but the revenue from public lighting was £1,000 less and the coal cost was very much higher than in the previous year. There was also the cost of war bonuses and allowances to men on active service. With the exception of one year, the total costs were the lowest on record, the difference being due to the high cost of coal.

Glasgow: *High Coal Cost.*—It is stated that the Glasgow Electricity and Gas Departments will pay £250,000 extra for coal during the coming year. The Electricity Department has increased its rates by 15 per cent., and there is a hint that further increases may be necessary.

London: *St. Pancras: War Loan.*—The Electricity Committee has invested £10,000 from Reserve Fund in the War Loan.

Plant Extension.—In connection with the scheme for extending the King's Road Electricity Works at an estimated cost of £49,818, the Council has been approached by the Treasury, through the L.C.C., as to the possibility of postponing this. The Electricity Committee report that quite apart from the fact that two new boilers have already been contracted for, it will be necessary to proceed with these in order to be able to supply factories working on Government orders. The original scheme included four boilers, but the installation of the second two is to be postponed. A new 5,000 kw. turbo-alternator is in process of construction as part of the scheme. Expenditure to the extent of £25,053 is therefore to be postponed.

Mansfield: *Profits and Relief of Rates.*—The Electricity Committee has voted £600 out of last year's electricity profits to the relief of rates.

Oldham: *Mains Accident.*—There was an unfortunate accident on the mains recently, due to a rather curious cause. When the cables were laid about 20 years ago they were fixed in direct contact with a gas main, and a fault on the cable was sufficient to burn a hole in the gas main. The gas was naturally ignited, and a large blaze was emitted from the street-boxes. There was, however, no actual explosion.

Southampton: *Northumberland Clause Again.*—We mentioned on p. 282 of our issue of June 24th that the Southampton Gas Co. had been refused the "Northumberland" clause by a House of Commons Committee in respect of an extension of the Southampton electric supply area to include a small parish called Bitterne, the total capital expenditure upon which was estimated to be £400. The Gas Co., however, renewed its application for the clause when the Provisional Order in question came before the House of Lords Committee. Sir John Snell again gave evidence, but eventually the Committee decided to grant the clause in respect of the new extension only. The Gas Co. asked that the clause should be applied to the whole of Southampton, but the Corporation informed the Committee that if that were done the extension scheme would be dropped.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

St. James's & Pall Mall Electric Light Co.—Interim dividends at the rate of 7 per cent. per annum on both preference and ordinary shares for the June half-year are to be paid.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, JULY 29, 1915.

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SUMMARY

MR. T. ROLES has contributed a long written reply to the discussion on the paper by him and Mr. Blackman on the Point-Five tariff, read at the I.M.E.A. meeting (p. 320).

SOME notes are given on work recently accomplished and now in hand by the Engineering Standards Committee (p. 320).

THE Government Bill for limiting the price of coal has passed the Committee stage. In connection with existing contracts, which are excluded from the Bill, a promise has been given to deal in some way with any contracts entered into for next winter by Corporations and public utility companies (p. 321).

THE regulation of motor generators for plating work is dealt with in our Questions and Answers columns (p. 321).

AMONG the subjects of specifications published at the Patent Office last Thursday were A.C. motor control, microphones, heating circuits, telephony, and search-light carbons. The Board of Trade has granted a licence under an enemy-owned patent for sparking plugs (p. 322).

CONSIDERABLE interest attaches to the statement made at the annual meeting of Marconi's Wireless Telegraph Co. by the Managing Director as to State-aided competition from Germany and the position with regard to the Imperial wireless scheme (p. 322).

A CONFERENCE is proposed between the L.C.C. and

other traction undertakings with a view to diminishing competition and releasing more men for active service (p. 323).

AN illustrated article deals with the use of condensers for surge protection (p. 323).

THE process of making glass-house pots in the Ediswan Works is described in an illustrated article (p. 324).

A CORRESPONDENT calls attention to the dangers of dimming bare incandescent lamps by wrapping tissue paper round them (p. 325).

THE Treasury has refused to sanction the full capital expenditure proposed on the Battersea, Hammersmith and Fulham linking up scheme.—Loans have been sanctioned at Woolwich for mains and house wiring in connection with a munitions workers housing scheme, and for linking up with the South Metropolitan Electric Light and Power Co.'s power house.—Switchgear is required by the L.C.C.; substation plant at Stoke on Trent.—New generating plant (£91,417) at Coventry and Bury (£7,560); cables, transformers and switchgear at Walsall; cable at Rochdale; and mains, rotary converters, services etc., at York (p. 325).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING AUGUST 7TH, 1915.
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, Wednesday, and Friday:—Drills 6.30 and 7.30.

(There will be no drill on Monday, August 2nd.)

Applications for Enrolment:—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING.
(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Trade Exhibitions after the War.—A comprehensive scheme is on foot for erecting a large exhibition building or "Palace of Industry" for the holding of trade exhibitions in the London area, and in particular for a large industrial fair in the spring of 1917. Already a site of 44 acres has been acquired at Willesden Green alongside the Metropolitan Railway, within 7 mins. journey from Baker Street, and a building of 500,000 sq. ft. area will shortly be commenced. It is proposed that the profits of the exhibition be distributed among the firms participating in proportion to the space occupied by them, and the management is anxious to get into touch with the Trade Associations and Societies in the country which are not already represented on the Advisory Council. Communications should be addressed to Mr. W. Glass, Secretary, Industries of the Empire Fair, Lincoln House, High Holborn, W.C.

THE PRACTICAL RESULT OF THE POINT-FIVE TARIFF

WE have received from Mr. T. Roles (City Electrical Engineer, Bradford) a copy of his full reply to the discussion on the Paper by him and Mr. A. S. Blackman on the point-five tariff read at the meeting of the Incorporated Municipal Electrical Association in London on June 17th (see ELECTRICAL ENGINEERING, June 24th, p. 267).

Mr. Roles writes that the majority of the speakers seem to be under the impression that the rateable value tariff and the point-five tariff are synonymous, whereas, as a matter of fact, a number of point-five tariffs are in no way based on the rateable value system of charging. "The Point-Fives" Association as a body, he continues, holds the opinion that no great headway can be made in the supply of electricity for heating, cooking, and other domestic purposes, apart from lighting, at any price exceeding ½d. per unit, in districts in which gas is sold at 2s. 6d. or under per thousand cubic feet. In Bradford and Sunderland the fixed charge arrived at on a rateable value basis has been so calculated that, plus a charge of ½d. per unit for current used for lighting purposes as registered by meter, it is on the average equal to the cost of lighting a house moderately well throughout at between 3½d. and 4d. per unit. It follows, therefore, that on the average all units sold for heating and cooking purposes, and any increase of illumination above the ordinary, are obtained by the consumer at a flat rate of ½d. No member of "The Point-Fives" Association has claimed to supply electricity for all domestic purposes at a flat rate of ½d. per unit or less. The majority of the members, however, do claim to be selling electricity for heating and cooking purposes at ½d. per unit, whether their tariff is based on the rateable value system or on a flat rate for lighting and a separate flat rate for heating and cooking.

He had already given figures in the Paper which made it clear that, in the case of Bradford at any rate, there is no foundation for the suggestion that a point-five tariff under the rateable value system is a means of deluding the undertaking's consumers into believing that they are getting a substantial reduction and current for heating and cooking purposes at a low rate, whereas in reality they are not. With regard to the class of consumers attracted by the point-five tariff, he states that of the 566 point-five consumers supplied in Bradford during 1914, well over 50 per cent. resided in premises having rateable values of £30 or less. Mention had been made of the large number of gas cookers and fires in use in Hereford; the fear was expressed that if electricity was supplied at a low rate for heating and cooking purposes the Gas Department would suffer, and that, taking the two Departments together, the result would be a net loss to the Corporation. In Bradford it was found that the persons who adopted electric heating and cooking were not at the present time using gas, but coal, for these purposes, as they had a rooted objection to the use of gas for any purpose whatever.

The statement made that St. Marylebone is the only point-five undertaking which has not adopted the rateable value system, but has the kilowatt maximum demand system in operation, is totally incorrect. Both Poplar and West Ham are also working on the kilowatt demand system, and Southampton, Luton, and Wakefield have adopted a flat rate of ½d. per unit for heating and cooking purposes. Mr. Wordingham appeared to be under the delusion that the rateable value system and the point-five tariff are one and the same thing, as he states that "The Point-Fives" Association have re-discovered the "Hopkinson" system and are bringing it forward and advertising it for all it is worth. The reply to this statement is that neither the Association nor any of its members takes credit for the introduction of the rateable value system, but some members have applied the system—which had already proved its merits—to their own needs. In reply to Mr. Wordingham's scepticism in the possibilities of electric water heating, Mr. Roles stated as a fact that a number of electric water-heating installations are at present in use, are giving satisfaction, and are proving economical. With regard to Mr. Lackie's remark that before fixing the Glasgow tariff his main endeavour had been to see that the revenue per house was increased and not diminished, this was also the endeavour of Mr. Roles, providing that the increase was due to the installation of additional lights or of heating and cooking apparatus, and figures given in the Paper showed that the endeavour had met with success.

Mr. Long had asked how a point-five tariff could be justified in the case of towns in which the cost of coal per unit is in the neighbourhood of ½d. This question, says Mr. Roles, can only be satisfactorily answered by the engineers of the towns concerned. When fixing the amount to be allocated to standing and running costs under any tariff, it is usual for at least 25 per cent. of the coal costs, and considerably higher percentages of other items making up the works costs, to be debited to standing costs. If only 25 per cent. is taken off the figures given with regard to the average cost of coal per unit in the towns mentioned, the charge of ½d. per unit will compare

much better with the coal costs. It must also be remembered that the coal costs quoted are average costs, and that the cost of generating units during the hours of light load is very much higher than during the heavy load periods. In works supplying residential districts the number of hours of light load is very high compared with the number of hours during which a moderately good load is sustained. If, therefore, by selling electricity at a cheap rate for heating and cooking purposes, a good day load can be obtained, not only is the cost of generation reduced during the hours of light load, but the average figures per unit in respect of each item of works costs may also be appreciably lowered.

THE ENGINEERING STANDARDS COMMITTEE

THE first annual meeting since its reorganisation of the Sectional Electrical Committee, of which Sir John Snell is Chairman, was recently held to approve such work as was completed during the session and to receive the reports of the work in progress. The following reports, which have been transmitted to the Main Committee for ratification, will shortly be available:—British Standardisation Rules for Electrical Machinery; British Standard Specification for Electricity Meters; British Standard Specification for Charging Plug and Socket for Vehicles propelled by electric secondary batteries; British Standard Specification for Wall Plugs and Sockets, five-ampere, two-pin, without earthing device.

The Sub-Committee on electric power cables, of which Mr. C. P. Sparks is Chairman, has under consideration the revision of the report on copper conductors. The Sub-Committee on electric lamps will, in co-operation with the Tungsten Lamp Association, in the early autumn, consider the drafting of a standard specification for tungsten lamps, and the question of miner's electric lamps will also receive attention. The Sub-Committee on electrical accessories, of which Mr. C. H. Wordingham is Chairman, has several panels at work, and it is hoped that recommendations will soon be forthcoming in regard to motor-starters, heating and cooking apparatus, and fuses, as well as other electrical fittings. A panel has also been formed to revise the Standard Specification for ammeters and voltmeters, and on this panel the British Electrical and Allied Manufacturers' Association will be represented by Mr. E. B. Vignoles and Mr. Patrick Hamilton. The Sub-Committee on electrical symbols, presided over by Dr. A. Russell, has appointed two panels, one to draw up a list of graphical symbols for use in installation and power work, and the other to deal with telegraph and wireless symbols. The question of standards for distributing pressures for new systems, which has been brought forward by Mr. C. H. Merz, is to occupy the attention of a Sub-Committee under the Chairmanship of Dr. R. T. Glazebrook, upon which all interests will be represented. As an indication of the activities of the Committee, it may be mentioned that during the past year more than ninety meetings have been held, and from the above notes it will be appreciated that the electrical section is engaged on work of great importance to the industry at large.

Obituary.—We regret to record the death on July 16th, near Glasgow, of Mr. Henry A. Mavor, of the firm of Mavor & Coulson. Mr. Mavor, who was born in 1858, has long been well known in electrical circles, and in the early days did energetic pioneering work in the introduction of electric lighting in Glasgow. Since 1883 he has been a partner in the firm originally founded as Muir & Mavor. Among other branches of electrical engineering he turned his attention particularly to electrical work in mines, and carried out the earliest installations of the kind in Scotland. During later years he had interested himself in the problem of electric marine propulsion, and worked out more than one system of control in this connection. Two vessels have already been equipped with electrical transmission gear under his direction. Mr. Mavor had been in poor health for some time, and leaves three sons (all of whom are now on active service with the Army) and a widow.

A Handbook of Halifax.—Messrs. Sells, Ltd., have published an illustrated industrial handbook of Halifax under the auspices of the local Chambers of Commerce and Trade, which contains interesting particulars of this important commercial and industrial centre. Its aim is to show manufacturers and merchants at home and abroad the vast range of work produced from this centre, which is now as well known for its machinery as its woollens, and also to attract to this area those contemplating setting up new works by demonstrating the advantages of the town's position.

COAL SUPPLIES

AS indicated on p. 311 of our last issue, there is considerable feeling among certain Members of Parliament that the Government Bill for limiting the price of coal will fail completely to meet the object which those who framed it had in view. The limitation of the Bill does not apply to contracts already made, and it is said that a majority of the large electricity and gas undertakings, for instance, have already entered into contracts at a higher price than the maximum excess of four shillings allowed in the Bill.

The opponents of the Bill from this point of view made the most of their case during the Committee proceedings on Thursday, but the Government refused to regard the point as serious. The President of the Board of Trade contended that although a few public utility undertakings may have entered into contracts already, a large majority have not. Special mention, however, was made of the Glasgow Corporation, which has purchased large stocks of coal for its electricity undertaking at high prices, and in this connection the Government offered to see what steps could be taken to bring such special cases of local authorities and public utility companies within the provisions of the Bill. The necessary amendment was introduced into the Bill on Tuesday. It provides that any contract affecting local authorities, electricity, gas, or water undertakings, entered into since April 1st shall be subject to the limitation of price imposed by the Bill upon contracts entered into since the date of passing of the Act.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,453.

Is it practicable, and are there any circumstances in which it is advantageous, to take the excitation circuit of a 4-pole dynamo from one pair of brush arms while the other pair is used only for the load?

(Replies must be received not later than first post, Thursday, August 5th.)

ANSWERS TO No. 1,551.

A motor-generator for electroplating work is required to run off a 3-phase supply, and is to give out a current of about 8,000 amperes at a voltage variable between 4 and 8. Is it possible to obtain such a variation by the ordinary method of shunt regulation if the machine is self-excited, or is it better or necessary to arrange the fields for separate excitation? Could the variation in volts be satisfactorily accomplished by regulation on the motor side? What are the advantages or disadvantages of using carbon brushes as against copper gauze brushes on a generator of this size?

"W. M."

The first award (10s.) is made to "H." for the following reply:

The voltage variation required in the question could be obtained from a self-excited dynamo by means of shunt regulation; but the result would not be satisfactory, firstly, because at the lower voltage the machine would be working with a weak field, causing the voltage to be unstable—small fluctuations in the speed of the motor or in the resistance of the external circuit giving rise to large variations in the terminal voltage; secondly, the shunt current for the dynamo under consideration would probably be about 200 amperes at

the maximum voltage, and a regulator suitable for such a heavy current would be expensive to construct. For the voltage regulation required in the question, separate excitation is the only satisfactory solution. It may be mentioned that for sparkless commutation with a variable-voltage dynamo, interpoles must be fitted, otherwise armature reaction causes trouble when the main field is weak. As regards the suggestion of obtaining the regulation from the motor side, this is not economically possible unless a three-phase commutator motor is installed, since the speed variation required can only be obtained from an induction motor by inserting resistance in the rotor circuit—a most wasteful method. The high cost of the commutator motor, moreover, generally prohibits its adoption. If a separate continuous-current supply is not available, it will be necessary to put in a small exciter either directly coupled to or belt-driven from the motor-generator set. Any desired voltage variation can then be obtained economically and without any difficulty. For low-voltage dynamos it is the universal practice to employ copper gauze brushes, of which there are several excellent patterns on the market. The advantages of gauze brushes over carbon ones are:—(a) They can be worked at a much higher current density, and so require less area of contact, with the result that the brush friction loss is greatly decreased and the commutator can be made much shorter; (b) the voltage drop between gauze brushes and the commutator is only a small fraction of that between carbon brushes and the commutator, so that the loss due to contact resistance is correspondingly diminished; (c) the advantage of carbon brushes in improving the commutation is of little consequence in a case of this kind, where the reactance voltage is generally very low.

The second award (5s.) is given to "P. W. S." who writes as follows:—

To attempt to make a machine of this sort self-exciting and insert a regulating resistance in series with the field winding would result in the use of very cumbersome apparatus, as the field winding of such a machine must necessarily consist of heavy cable and take a large current in order to get the required number of ampere turns. A much simpler method would be to have a separately excited field winding, wound for a fairly high voltage, say 100; a light resistance could then be used with a large number of studs, the number depending upon the degree of fineness in variation of voltage required. As the amount of variation in voltage is so large, namely, 50 per cent., and this would mean approximately the same variation in speed with a fixed field resistance, it would hardly be wise to attempt to get it by altering the speed of the polyphase motor, as these do not lend themselves readily to efficient speed variation. The simplest method of altering the motor speed would be to insert a variable resistance in the rotor circuit, but this would mean a large waste of power. Copper gauze brushes are nearly always used on electro-plating machines on account of the much smaller commutation required. To collect 8,000 amps. with carbon brushes would require a commutator whose size would be out of all proportion to that of the machine, particularly if the machine has few poles. The only advantage of carbon brushes would be less tendency to spark and a longer life for the commutator.

Diesel Engines.—At a recent meeting of the Diesel Engine Users' Association, Mr. G. E. Windeler (chief engineer to Mirrless, Bickerton & Day, Ltd.) read a short Paper on the causes of cracking and seizing of pistons in Diesel engines. He expressed the opinion that the major portion of the defects that had arisen on cylinder covers and pistons were due to serious deposits formed in the water spaces of the cylinder covers and on the cylinder liners not during the time the engine was working, but after the engine was shut down. The piston, cylinder cover, valves, &c., have a large number of heat units stored in them, and when the engine is shut down these heat units are absorbed by the water which remains in the jacket, the quantity of which is comparatively small, and a very considerable rise in temperature takes place; in fact, sufficiently high in the majority of cases to throw down the salts which were held in solution in the water. Where the circulating water is known to be of a considerable hardness, it should run through the water spaces for some time after the engine is shut down. He went into various matters connected with piston design, and said that seizures of pistons were also invariably due to heating of the piston pin and its bearing, and take place almost immediately after starting up. When an engine has been set to work and shut down, the heat stored in the piston body is thrown down and tends to evaporate the oil in the top end bearing, with the result that when the engine starts up again this particular bearing is not amply supplied with lubricating oil.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 22nd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

683/14. **Motor Control.** J. L. ROUTIN. Means for collectively controlling a number of A.C. repulsion motors required to be run at equal speeds, in which the rotors of all the motors are provided with slip-rings electrically connected together to couple the machines, so that they must run in step with one another. (One figure.)

7,922/14. **Microphones.** A. F. SYKES and S. FORD. A microphone in which the sound waves act upon and control the variation in the amount of a conductivity changing substance added to a stream of liquid passing between two electrodes, and thus causes variations in the resistance of the circuit. (Eight figures.)

8,280/14. **Supply Circuits.** R. ARNO. A method of rendering circuits intended for the supply of heating apparatus only unavailable for lighting purposes by causing periodic momentary interruptions by an automatic thermal or other switch. (Four figures.)

8,794/14. **Telephony.** P. L. M. DRUMAUX. Reciprocal connections for two telephone lines connected with a relay for annulling or impairing the tendency to produce disturbing oscillations, characterised in that the relay is connected with the telephone lines by the interposition of artificial lines having inductance and capacity with comparatively small resistance and leakage, and being tuned and calculated in such a manner that the telephone currents propagate in an undulating manner with comparatively low frequency, small damping effect, and small distortion. One non-reflecting translator can be inserted between each of the artificial lines and the main line. (Two figures.)

15,485/14. **Search-light Carbons.** PLANIWERKE A.G. FÜR KOHLENFABRIKATION. The negative carbon is kept of very small dimensions relatively to the current it has to carry by being made of a mixture of carbon and about 40 per cent. of graphite.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. Co. (G.E. Co., U.S.A.) [Distributing system] 18,288/14.

DYNAMOS, MOTORS AND TRANSFORMERS: SCOTT [Armature windings] 16,093/14; SIEMENS BROS. DYNAMO WORKS, LTD., and KIEFFER [Cooling dynamos] 16,979/14; BURDEN (Siemens Schuckertwerke Ges.) [Laminated slot keys] 24,078/14; SCOTT [Dynamos and motors] 6,618/15.

BALL [Electric heating element] 20,286/14; VARVEL [Electric water heater] 23,293/14.

INCANDESCENT LAMPS: GLADITZ [Incandescent lamps] 9,110/14.

INSTRUMENTS AND METERS: HATFIELD and CHAMBERLAIN & HOOKHAM, LTD. [Electrolytic meters] 26,899/13; A. E. G. [Induction meters] 11,844/14.

SWITCHGEAR, FUSES AND FITTINGS: JESSEN [Switches] 4,447/14; C. A. SHAEFFER [Lampholders] 8,806/14; WILSON and HARLOW [Motor starters] 15,939/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Circuit breakers] 19,587/14; LIVERSIDGE and PENNSYLVANIA APPLIANCE CO. [Fuses] 131/15.

TELEPHONY AND TELEGRAPHY: SIEMENS BROS. & CO., LAIDLAW and GRINSTED [Telephone circuits] 26,905/13; GOLDSCHMIDT [Spark gaps] 2,214/14; POLYPHOS ELECKTRIZITÄTS GES. [Production of electric waves] 4,664/14; SIEMENS & HALSKE A.G. [Telephone circuits] 8,800, 9,103 and 9,105/14; MARKS (International Quadruplex Co.) [Telegraphy] 16,342/14; STERLING TELEPHONE & ELECTRIC CO. (Telephon Fabrik A.G. vorn. J. Berliner) [Relays and indicators] 16,418/14; EASTERN TELEGRAPH CO. and DAVIES [Relays] 16,471/14; HUGHES and COOPER [Telephone systems] 16,712/14; ZIERAU [Attachments for telephones] 18,607/14; GRINSTED [Telephone circuits] 821/15.

TRACTION: LAUTENBACHER [Trolley wires] 25,951/13; CEDES ELECTRIC TRACTION, LTD. and BOWEN [Trolley-wire junctions] 15,946/14; DOUGLAS and HODGSON [Staff exchangers] 19,441/14; HUE [Signalling apparatus] 19,950/14; HENSHER [Automatic signalling] 22,109/14; R. BOSCH [Car lighting] 5,184/15.

MISCELLANEOUS: H. ARON ELEKTRICITÄTSZÄHLERFABRIK [Electric clocks] 26,631/13; JAKOWLEW [Electric massage apparatus]

2,290/14; SMITH [Signalling in mines] 8,305/14; MARKS (Soc. Gallot & Cie.) [Medical magneto machines] 9,278/14; GODFREY [Electro-mechanical selectors] 9,718/14; SCHOLZ [Carbon electrodes for batteries] 10,171/14; STERLING TELEPHONE & ELECTRIC CO. and BELL (Telephon Fabrik A.G.) [Mine signalling] 13,062/14; BURT [Controlling race starting barriers] 16,315/14; STERLING TELEPHONE & ELECTRIC CO., BELL and DUNGEY [Mine signalling] 18,661/14; JOHN DAVIS & SON and DAVIS [Magnetic lock for miners' lamps] 21,046/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: MASCHINENFABRIK OERLIKON [Stator casings] 8,417/15.

TELEGRAPHY AND TELEPHONY: AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. [Telephone systems] 9,396/15.

Applications to Avoid or Suspend Patents

28,412/12. **SPARKING PLUGS.** A. RUPRECHT. The Board of Trade has granted a licence under this patent on the application of H. W. Van Raden (trading as Davies and Walker). The specification describes a method of constructing sparking plugs with a split inner sleeve which keeps the porcelain tight. The following are the more important Patents that have become void through non-payment of renewal fees.

DISTRIBUTING SYSTEMS, CABLES AND WIRES, INSULATING MATERIALS, &c.: W. A. T. MÜLLER [Distributing system] 7,595/09.

DYNAMOS, MOTORS AND TRANSFORMERS: H. C. PEAKE and J. R. ENGLAND [Coal-cutter motors] 7,980/02; W. L. EMMET [Electric transmission for marine drive] 7,829/07; R. D. MERSHON [Incorporation of condensers into armature windings for improvement of power factor] 8,183/07; ATELIERS B.T.-H. (Paris) [Prevention of sparking in single-phase motors] 7,621/08; J. P. HALL [Ventilation of dynamos and motors] 7,854/08.

ELectrochemistry and Electrometallurgy: E. STASSANO [Electric arc furnaces] 8,288/02.

TRACTION: G. WESTINGHOUSE [Electro-pneumatic train control] 8,256/03; E. C. KETCHUM [Steam turbine locomotive with electric transmission] 7,750/08; A. SPENCER [Train lighting] 8,165/09.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The proceedings at the annual meeting of Marconi's Wireless Telegraph Co. on Monday were more than usually interesting by reason of a statement by the Managing Director as to the difficulties which the Company has had to encounter from German competition. Mr. G. Marconi, the Chairman of the Company, who is now a lieutenant in the mounted section of the Italian Royal Engineers, presided, he being in this country at the moment on Italian Government business. In placing the report and accounts (given in our last issue) before the shareholders, the Chairman mentioned that for the moment the Company's work in many parts of the world has come to a standstill owing to wireless telegraph apparatus being contraband. On the other hand, the factory is fully occupied in carrying out important orders both at home and abroad in consequence of the war. Since last year important developments in wireless telegraphy had taken place, and the Company had applied for several new patents, information concerning which, however, could not be given at the moment. Generally speaking, all the affiliated companies had shown satisfactory progress during the past year, and the high-power stations at San Francisco and Hawaii have been completed, the Company awaiting daily information as to the opening of a through service to Japan. The Chairman concluded with a reference to the work which the Company is doing for the British Government, and without entering into details said that more than one letter of appreciation from the Lords Commissioners of the Admiralty had been received in respect of this work. At the same time he paid a great tribute to the work of Mr. Godfrey C. Isaacs, the Managing Director of the Company, since his association with it in 1910. Mr. Godfrey Isaacs then addressed the shareholders at some length, and went into details of the position of the Company

in 1910 and its progress since. At that time, he said, the Company had practically no cash resources and no credit. Indeed, within a few weeks of his joining the Company he had to draw a cheque on his own banking account to pay the salaries due for the preceding month. To-day the Company had a capital of £1 million sterling, and was in a very sound financial position. The reasons for the lack of prosperity in the early days of the Company were, he said, due to the fact that immediately Mr. Marconi started the Company he was imitated in Germany, where a big German company was created, practically by the German Government. It was directed by some of the most eminent and able commercial men in Germany, and had the further great advantage of the financial aid of some of the principal German banks, whilst finally it had a very large subsidy from the German Government. This company created powerful agencies in practically every country in the world with the exception of Italy, France, and Great Britain. Not only had the English Company to contend with German agents, but also with German Ambassadors. The position was found to be so impossible that he made a direct appeal to Sir Edward Grey, and from that time forward the support of British Ministers abroad was obtainable in the Company's different negotiations with foreign Governments. From then the Company commenced to make substantial progress until it had reached undoubtedly the preponderating position throughout the world. Then came the suggestion of the Imperial wireless scheme, by which high-power stations were to be erected at the Company's expense in all British possessions, to be worked by the Company during peace, and handed over to the Government in the event of war. Difficulties arose in Parliament, however, and eventually the later Government scheme came into being. Meanwhile, the German Government, without discussing the matter publicly at all, began to build a chain of wireless stations in all German colonies. He was informed that the price paid for each of these stations was three times the price which the Marconi Co. had asked of the British Government, whilst there was a subsidy far larger than anything contemplated by the Marconi Co., which was to be paid not for eighteen years, as in our case, but twenty-five years. This scheme cost the German Government two millions sterling, and it might be thought to have been a very bad investment. Close investigation, however, proved this not to be the case, for at 5 o'clock on the afternoon of August 4th last year (the British ultimatum to Germany expired at midnight on the same day) the German Government sent out from all its wireless stations a message to this effect: "War declared upon England; make as quickly as you can for a neutral port." By that message Germany contrived to save the greater part of its mercantile marine. Even had it only saved one of its big ships of the *Vaterland* class, it would have paid for the whole cost of the wireless stations; but it was, of course, well known that this message did considerably more than that.

ELECTRIC TRACTION NOTES

It is proposed that a conference between the London County Council Tramways Department and the omnibus companies in London should be held under the Chairmanship of a representative of the Local Government Board to consider to what extent agreements can be arrived at to eliminate competing services in order to release more men for the Forces.

The scheme for the conversion of the capital of the British Electric Traction Co., which was temporarily put on one side last year owing to the war, was adopted at an extraordinary general meeting on Friday. Since it was last placed before the shareholders there have been one or two modifications, and it now provides for the reduction of the present total capital of £2,947,380 by £908,872, and to divide the capital thus reduced into 6 per cent. cumulative participating preference stock and ordinary stock.

The Bill promoted by the Underground Electric Railways Co. of London for the purpose of bringing about closer co-operation in the working of the various electric railway companies in London in which it is interested is now unopposed in Parliament. As we have already reported in our columns, opposition was offered by the London County Council, but the promoters have gradually met the points raised, and the Bill is now considerably modified in the direction of it not being possible under it to complicate the actual position of each Company individually.

SURGE PROTECTION

THE subject of protection of alternating-current systems from voltage surges is very fully treated in new Bulletin which has just been issued by the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.). The cause and nature of such surges are discussed, and after a brief discussion of the capabilities and limitations of the horn, aluminium, and multi-gap patterns of arrester, the claims of condenser protective gear, which is not as familiar to engineers in this country as it should be, are put forward, particularly as regards the Moscicki condenser, which was specially developed and is largely in use abroad for this kind of work. It is pointed out particularly that this form of protector can be connected direct to the line without an air-gap or series resistance, and that there is no dielectric spark lag. Again, it is the only arrester discriminating adequately between the low frequency of the line and the high frequency of the surge, and it does not permit live current to flow during the time that it is discharging the surge, beyond the small charging current of low power factor which flows continually. The condenser is the only surge protective device which modifies

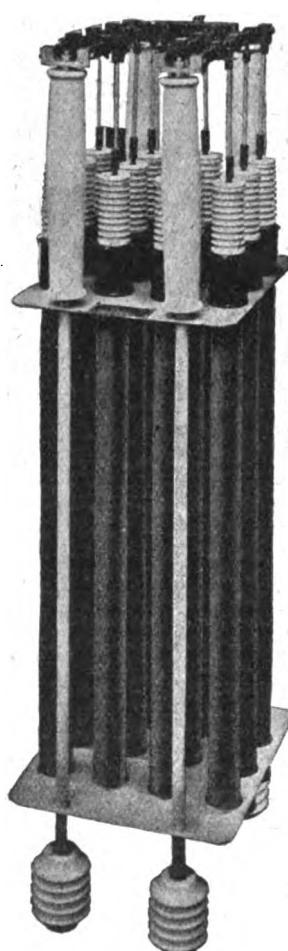


FIG. 1.—MOSCICKI CONDENSER.

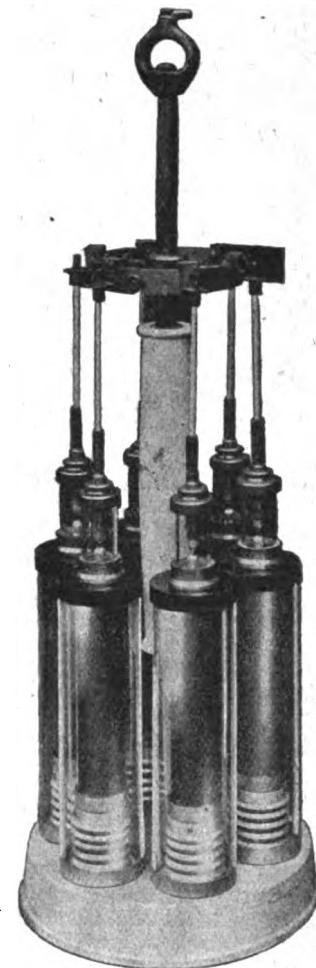


FIG. 2.—GILES VALVE.

the wave-form of steep-fronted waves, and when properly arranged is capable of effecting a reduction in the surge pressure of a 100,000 cycle per second surge to 0.067 of its value and a 1,000,000 cycle per second surge to 0.007 of its value. It will be remembered that the Moscicki condenser consists of a glass tube composed of a special glass mixture, the inner and outer surfaces being coated with chemically-deposited silver which is afterwards plated with copper. At the neck the tube thickens considerably in order to withstand the static stress which at this point is greater than at any other part of the surface. This construction enables the thickness of the dielectric to be reduced to a minimum, thereby giving a high capacity, whilst there is ample security against a perforation of the dielectric. The neck of the condenser is enclosed by a high-pressure china insulator, the space between the neck and insulator being filled with an insulating compound in such a way that the edge of the coating is completely buried in this mass, and no surface discharge can occur. Each condenser is mounted in an iron tube, the space between the condenser and tube being filled with a mixture of water and glycerine, so that any local

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heating which might result in the perforation of the dielectric is rendered impossible. A view of a battery of small Moscicki condensers is shown in Fig. 1.

An appliance which meets the case where high pressures may be present without high frequency, such as where there is resonance with the fundamental or a low harmonic, is the Giles valve, which is in effect a multi-gap arrester with the individual gaps shunted by condensers. The way this apparatus is arranged is shown in Fig. 2. Summing up the comparison of the different methods of protection, it is pointed out that no single device, be it a condenser, aluminium arrester, multi-gap arrester, Giles valve, or any other, will of itself completely protect a system. One device will protect against high voltage, another will protect against high frequency, but no single one will protect against all. The condenser is the only one which protects against excess pressures of high frequency, and against steep wave front, and with it must be installed a complementary device to protect against surges of low frequency but high voltage. The Giles valve is the best for this purpose, and the combination of Giles valve and Moscicki condenser affords a thorough protection of the system.

The Bulletin further deals with protection against static charges by small inductance coils between line and earth and by the water-jet method, and the protection of continuous-current circuits by a special form of electrolytic condenser composed of two sets of aluminium plates wound together spirally round a vertical axis.

The circumstances in which protective gear is particularly necessary are discussed, and the conclusion is arrived at that, apart from the dissipation of surges of external origin, protective apparatus is essential at those two points where systems of different surge impedance, in which surges may reasonably be expected to originate, are connected together. Typical examples are the junction of long underground and overhead mains, a cable entering or leaving a sub-station or power house, a connection from a long overhead line to a large motor, and so forth. The exact nature of the protective scheme will depend upon the circumstances. Sometimes condenser protective gear will suffice, sometimes Giles valves will afford the necessary protection, while frequently the two will be combined.

GLASSHOUSE POT-MAKING AT EDISWAN WORKS

THE photographs reproduced in Figs. 1 and 2 will help to make clear a very interesting industry, which is little known to electrical trades, but is carried on by the Edison & Swan United Electric Light Co., Ltd., at their Ponders End Works. This industry is "glasshouse pot-making," the pots being used in the manufacture of glass for the bulbs and tubes of Royal "Ediswan" lamps. Our illustrations show the interior of a room specially built for the making



FIG. 1.—WORKING CLAY FOR GLASSHOUSE POT-MAKING.

of glasshouse pots. This room, when filled, holds 120 glasshouse pots of a size suitable for the furnaces at the company's works.

The clay of which these pots are made comes from the Stourbridge district, and is the finest mixture which can be procured for this class of work; it is delivered to the works in bags in a dry state, when it is taken in hand by skilled workers, who add the requisite amount of water, after which the clay is allowed to stand by for a time, when it is again taken in hand and tempered, being turned and trod by skilled men with their bare feet (see Fig. 1) until it is in a

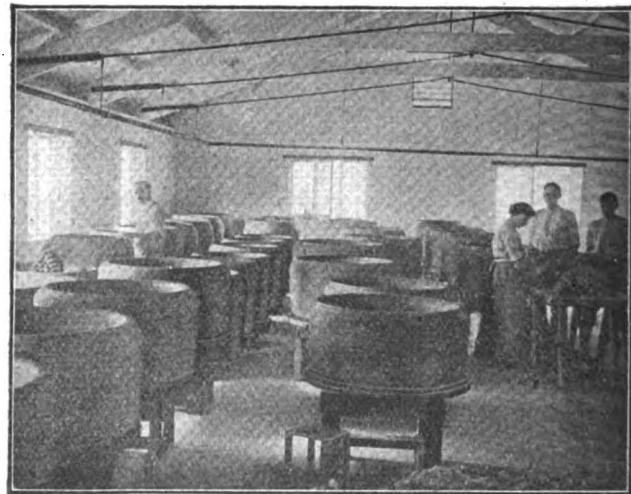


FIG. 2.—GLASSHOUSE POT-MAKING AT EDISWAN WORKS.

sufficiently plastic state for the pot-maker to start operations, various stages of which can be seen in Fig. 2. These pots require to be made at least 12 months before being used, the method adopted here being to dry them to a sufficient state of hardness to allow of their being moved to a room where more direct fire heat is allowed to play on them until they are sufficiently hard or dried to be transferred to the pot arch, when they require at least 14 days to burn sufficiently to temper them before being transferred to the furnace, when they are ready to be charged with the ingredients for the manufacture of the glass required for electrical work.

An illustration is also given in Fig. 3 of "Vitrite" lamp-

cap making at the Ediswan Works, which will help to show those who are unable to see for themselves that "Royal

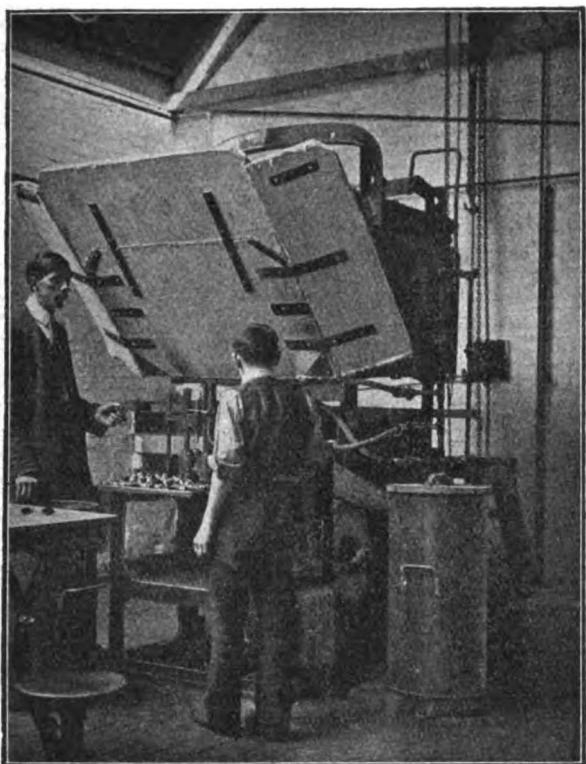


FIG. 3.—VITRITE LAMP CAP PLANT AT EDISWAN WORKS.

"Edison" lamps are entirely manufactured at the Ponders End Works.

CORRESPONDENCE SHOP LIGHTING.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In December last (see ELECTRICAL ENGINEERING, Dec. 10th, p. 635) I sent a letter to your paper in regard to shop-window lighting in war-time, dealing with the amateurish attempts made by shopkeepers to conform to regulations. I drew attention to the much favoured method of wrapping tissue-paper around bare lamps, and pointed out that not only was this very ineffective, but was a distinct source of danger, as witnessed by the large amount of badly scorched tissue-paper seen. The note of warning which I struck in that letter was amply justified in the Press this week, where it was stated that the L.C.C. Fire Brigade was recently called to an outbreak of fire caused by crinkled paper round electric lamp bulbs in a shop-window. One is led to wonder how many small outbreaks, not necessitating the attendance of the Fire Brigade, have been caused by this highly dangerous practice. The system I mentioned in my December letter was the scientific lighting of shop-windows by means of concealed lighting units placed high in the window. This method ensures the effective lighting of the articles displayed with complete control to accord with the lighting restrictions of the police, and has the additional merit of being safe and free from danger of fire. A large number of shops have been lighted on this approved plan, and give absolute satisfaction to all concerned.

Yours very truly,

F. W. WILLCOX,

General Manager, Lamp and Wiring Supplies Department.
Mazda House, 77 Upper Thames Street, E.C.
July 24th, 1915.

"Manganesite."—As it has been stated in some quarters that "Manganesite," lately advertised in our pages, is a German manufacture, Messrs. John Hudson & Co.'s Successors (4 Victoria Warehouses, Mansell Street, London, E.) ask us to make it known that although, until the outbreak of the war, they sold goods made at their German works, since September they have sent out no "Manganesite" except that made at their works in London. The firm has decided to abandon the German works for good, and they assure us that there are no aliens—naturalised or otherwise—connected in any way with this business. During the last twelve months large quantities of manganesite have been supplied to the Admiralty, War Office, and other Government Departments.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

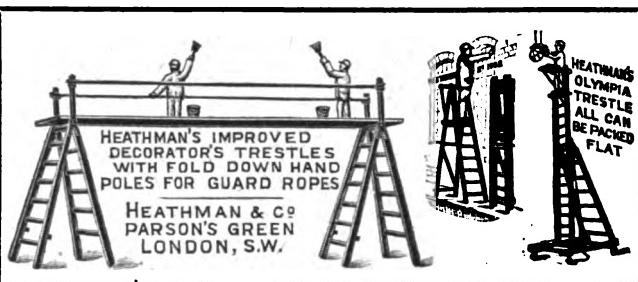
Bury.—Extensions at an estimated cost of £7,500 are to be carried out at the electricity works.

Coventry.—Subject to satisfactory assurances from the Minister of Munitions, the Electricity Committee recommends an expenditure of £91,417 upon new plant to deal with factories working on Government orders. The Council desires to be safeguarded against loss on capital account in the event of a cessation of the additional demand for power.

Earby.—Dynamo, battery, wiring, &c., at Sewage Disposal Works. Engineer and Surveyor, Council Offices. August 16th.

London: *Battersea-Fulham-Hammersmith.*—In connection with the scheme for linking up the Battersea, Fulham, and Hammersmith undertakings, the Battersea and Fulham Borough Councils have applied for sanction to the borrowing of £5,814 and £8,376 respectively as their shares of the cost. The Treasury has intimated to the London County Council that there is no objection to the loan in the case of the Battersea undertaking on the understanding that the expenditure is urgently necessary for the effective maintenance of existing supplies. The Finance Committee of the L.C.C. is advised that the only work which complies with the Treasury requirement is that relating to the linking up of the generating stations of the Battersea and Fulham Councils. It is proposed, therefore, to limit the loans for the present to the cost of this work, which is calculated at £2,618 in the case of both Battersea and Fulham; the cost of the main, with an additional £1,850 in the case of Fulham for a transformer.

Poplar.—The Finance Committee of the L.C.C. recommends sanction to a loan of £10,188 for new machinery. The Borough Council states that the proposals put forward are the minimum necessary to meet next winter's demands augmented by war requirements, and the L.C.C. Finance Committee states that there is good evidence in support of the application. The Treasury state that although they will not raise any objection to the borrowing on condition that expenditure under the sanction is limited during the war to purposes for the furtherance of the war, and the amounts authorised to be borrowed must be provided out of funds



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under the control of the Borough Council without resort to other sources for the next eighteen months.

St. Pancras.—The long discussion between the Borough Council and the L.C.C. as to accelerating the repayment of certain outstanding debts on the electricity undertaking has been brought to a head by a resolution of the L.C.C. Finance Committee agreeing to a loan of £15,000 for a new turbo-generator, with the reservation that the order for the loan will not be issued until the Borough Council has agreed to repay, within a reduced period equivalent to one-half the periods now unexpired but not exceeding fifteen years, the debt now outstanding on the plant and machinery, for which a term of forty-two years has been granted, and which will, by the introduction of the new machinery, in the opinion of the Council, fall within the category of stand-by or reserve plant.

Woolwich.—The Finance Committee of the L.C.C. recommends sanction to loans of £1,117 for mains and £1,055 for house wiring. The whole of this expenditure is necessary for dealing with a supply of electricity to 220 houses forming part of a housing scheme which H.M. Commissioners of Works are carrying out at Eltham for workmen engaged in manufacturing war materials.—Sanction is also recommended to a loan of £4,700 for linking up the Borough Council's electricity undertaking with that of the South Metropolitan Electric Light & Power Co. The Director-General of Munitions has intimated that it is very desirable in the public interest that arrangements should be made at once for the two undertakings to be linked up. The scheme involves a 10,000-volt main and two 750-k.v.a. transformers and switch-gear.

L.C.C.—An expenditure of £11,800 is authorised for switch-gear in connection with a reserve supply of electrical energy for tramway purposes from outside sources.

Mexborough.—Application is to be made for a loan of £4,000 for new plant.

Rochdale.—A twelve months' supply of paper-insulated cable. Borough Electrical Engineer. August 4th.

Stoke-on-Trent.—An expenditure of £1,085 is contemplated upon a new sub-station.

Walsall.—Sanction has been received to the following loans:—Cables, £10,000; transformers, £5,500; switchgear, £3,444.

York.—The L.G.B. has approved of the following loans:—Mains, £7,047; rotary converters, £4,491; static transformers, £830; and services, £1,626. Some portion of the above has already been incurred, and the Board has warned the Corporation against incurring expenditure in future in anticipation of sanction.

Miscellaneous

South Africa.—The Johannesburg Corporation requires 8,600 drawn-wire spiral filament traction lamps; also spare parts for tramears. Tenders to the Town Clerk by August 25th. Copies of specification may be consulted at the Commercial Intelligence Branch of the Board of Trade, and it will be noted that the date for receipt of tenders is useful only to those firms who can instruct agents by cable.

APPOINTMENTS AND PERSONAL NOTES

Early last year an arrangement was entered into by the L.C.C. Tramways Department with Messrs. Kennedy & Donkin providing for Sir Alexander Kennedy to advise and report upon the extension of the Greenwich power-house, the retaining fee being £500 per annum, with a commission ranging from 3 to 5 per cent. on new constructive work. It is now proposed to continue this agreement as a yearly one with the same retaining fee and a commission of 5 per cent. on new constructive work up to £50,000 a year, and 4 per cent. on work exceeding that amount. In the case of new constructive work connected with the second stage of the extension at Greenwich, which is being carried out sub-



stantially to specifications prepared by the Chief Officer of Tramways, the commission is to be 3 per cent.

Mr. E. G. Okell. Borough Electrical Engineer to the old Plymouth Corporation, has been appointed to take charge also of the Devonport undertaking upon the resignation of Mr. J. W. Spark, on appointment as Borough Electrical Engineer at West Hartlepool. Mr. Okell's salary in future will be £600, rising to £650, per annum. Devonport was last year amalgamated with Plymouth.

Mr. R. M. Jockel. charge engineer in the York Electricity Department, has been appointed engineer at the Northern Counties Co.'s Malton power-house. Mr. Edwards, junior charge engineer, succeeds Mr. Jockel.

A shift engineer is required in the Stockton-on-Tees Electricity Department. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £88 to £89 (last week, £90 to £91).

Holidays.—The "Z" Electric Lamp Manufacturing Co., Ltd., will close their factory from August 2nd to 7th inclusive.

LOCAL NOTES

Birmingham: Treasury Restrictions on Loans.—Having considered the Treasury restrictions upon municipal loans, the Electricity Committee have informed the Town Clerk that sums amounting to £253,414 will be required to be borrowed during the current year in respect of the new power station. This large expenditure, it is pointed out, is absolutely necessary in consequence of the large demands chiefly from manufacturers of war materials.

Brighton: Electricity Deficit.—There was a deficit of £1,354 on the electricity undertaking last year. The total revenue was £4,224 less than in the previous year, but the working expenses, exclusive of capital charges, remain approximately the same. Coal has cost an average of 2s. 3½d. per ton more than in the previous twelve months, but owing to the more economical operation of the plant the weight of coal per unit sold has been still further reduced, being now 3·97 lb. as against 4·06 lb. in the previous year, and 4·18 lb. in the year before that. The total extra cost of coal was £2,966.

Bristol: Satisfactory Electricity Accounts.—There was a net profit of £6,374 upon the working of the electricity undertaking last year, after allowing for an expenditure of £3,524 upon works of a capital nature. The increase of 502 in the number of consumers is the largest in any year except 1913 1914, when the number was 541. The power connections now represent 19,542 h.p., and applications are in hand for some thousands of additional h.p. The revenue per unit sold has fallen to just under 1½d., whilst the generating costs have fallen to 0·668d., a record for the undertaking, and five per cent. below last year's figure.

Edinburgh: Estimates for 1916.—The estimated capital expenditure on the electrical undertaking for the current year is £37,000, which includes £23,000 for the new power station at Portobello. The charge for current for lighting purposes has been increased to 2½d. per unit, and on this basis a balance of £540 is estimated for the year.

Fleetwood: "Municipal Wiring."—Considerable discontent has been shown by the electrical contractors in Fleetwood because the employees of the Electricity Department have hitherto been allowed to carry out private installation work in their spare time. This is regarded as unfair competition. Moreover, the Council itself is not in a position to carry out wiring work. The Council has decided, however, not to take any action in the matter at present.

Warrington: Tariff Increases.—A 10 per cent. increase is to be made from August 1st on charges for electricity for lighting and tramways, and 15 per cent. increase for heating and power, except where the price is regulated by a stipulation as to the varying cost of coal.

ELECTRICAL ENGINEERING

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(Established 1884)

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Other Advertisement Rates on Application.

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Letters for Insertion, Tuesday First post.

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Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Telegrams: "Circling, Fleet, London." Telephone No.: 5509 Holborn.

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

WE deal with the coal supply outlook in a special article (p. 328).

TWO further electric miners' lamps have been approved by the Home Office, making a total of 17 for general use and nine for special purposes (p. 328).

SEVERAL patents relating to electrical working in mines and to electrometallurgy have been published during the past month. The subjects include electric signalling gear, switchgear, safety lamps, and electric furnaces (p. 329).

A SYSTEM of shot firing controlled from the surface in use in an American mine is described (p. 329).

THE connections of star-delta starters for induction motors are discussed in our Questions and Answers columns (p. 330).

PARTICULARS are given under Electric Traction Notes of some new American electric locomotives (p. 331).

AMONG the subjects of specifications published by the Patent Office last Thursday are electrolytic meters, wireless telegraphy, metal filament lamps, and telegraph relays. A patent for a method of ventilating accumulators in submarines expires this week after a full life of 14 years (p. 332).

AN interesting lecture on field telephones was given last week before the Royal Society of Arts. Flag signalling has practically gone out of use at the front, the telephone taking its place. The bell call has been abandoned in favour of the buzzer, as with the latter Morse signalling can be carried on where, owing to the

noise, speech might be impossible. Methods of multiple lines for maintaining continuous communication were described, and a scheme for training telephonists was suggested (p. 333).

A LOAN of £7,500 is to be applied for by the Bury Corporation; an extension scheme is to be carried out at Erith, and a converter is required at Manchester (p. 333).

THERE was a deficit on the Glasgow electricity undertaking last year. Southampton has abandoned its "Point Five" tariff. Proposals are made for investigations into the working of the Manchester and Bristol electricity undertakings, but neither need be taken too seriously. A West Ham electrical employee has been awarded £350 compensation in respect of an electric shock (p. 334).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING AUGUST 7TH, 1915.
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, Wednesday, and Friday:—Drills 6.30 and 7.30.

(There will be no drill on Monday, August 14th.)

Applications for Enrolment:—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING.

(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

THE prospectus of the University Courses in Electrical Engineering and other subjects for the forthcoming session at the Manchester Municipal School of Technology has been issued, which contains full summaries of the hours per week that are devoted to the different subjects, general details of the organisation and work of the College, and an account of the equipment of the laboratories. The principal of the school, which works in connection with the University of Manchester, is Mr. J. C. Maxwell Garnett, and the Electrical Engineering Department is under Prof. Miles Walker, assisted by the following lecturers and demonstrators: Mr. J. Lustgarten, Mr. A. E. Moore, Mr. J. Hollingsworth, Mr. F. Shaw, and Mr. B. Hoyle.

A special course of instruction in electrical measurement and practical electricity, under Prof. E. Taylor Jones and Mr. W. E. Williams, will be commenced next term at the University College of North Wales, Bangor. Full particulars can be obtained from Mr. J. E. Lloyd, Secretary and Registrar.

Obituary: Killed in Action.—News has been received that Major Gardiner (R.E.), who was reported missing in December, was killed in action at Givenchy on December 20th. Major Gardiner was an associate member of the Institution of Electrical Engineers, and did much work in India. Some years ago he invented a system of cab signalling on railways.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

THE COAL SUPPLY OUTLOOK

TAKING all things into consideration it is not too much to say, as a result of the national conference between the mining industry and the Government in London on Thursday, that the prospects of increased supplies of coal are not promising. According to Sir John Simon, who presided over the conference—the object of which was to appeal to the owners and men to do everything possible by way of relaxation of rules and regulations, harder work, and so on, to increase the output—our coal supplies are short by some 3,000,000 tons per month, owing to the enlistment of 250,000 miners. The importance of this shortage to the electricity undertakings of the country, not to mention other large users, cannot be overstated, and the seriousness of the position is not lessened by the frame of mind of both owners and miners at the conference. Whilst the political speeches of the Home Secretary and the Minister of Munitions may appeal to the popular imagination, and the general proposition of the need of more coal in the national interest is accepted by owners and miners alike, the fact still remains that any extra efforts on the part of the coal mining industry are to be coincident with concessions of one sort or another by the Government. It is difficult to avoid the conclusion from the speeches that whilst the owners are doubtful of what the Government may do in the future, the miners distrust both owners and Government. The resolution which was passed to the effect that every effort should be made to secure the greatest possible output of coal during the period of the war binds neither side to anything specific, and, eliminating the political speeches, the whole tenor of the proceedings was that the owners and men must be allowed to confer and decide what steps, if any, could be taken and that anything so decided upon must be accepted as final. The hint was given by the men that any interference with the Eight Hours Act would be resented, whilst the owners urged that greater facilities for the export of coal should be given.

Other issues, however, are involved. The miners take up the position that an increased output per day per man is a physical impossibility, and add that even if in one or two isolated cases a miner may feel physically able to increase his output, there must be safeguards against the owners using the increase as a pretext for lowering the piece rate over the whole district. It is admitted, however, that extra output is possible in another direction. In Yorkshire, pits are said to be working two-and-a-half, three and four days per week whilst the men are willing to work six, but are prevented from doing so through lack of trucks. Therefore there is an indisposition for a general abandonment of the Saturday holiday without an assurance that trucks will be available to carry away the increased output. Again, the suggestions for lowering the age of boys to be employed and increasing the number of women employed at the surface are objected to, the latter by both the miners and owners.

The colliery proprietors claim the right to ask for a clear and well defined Governmental policy, which will dispel the misgivings in the minds of many as to what may be done in the future. The industry, it was said, wants to know that the Government is behind it, and when that was known every possible restriction

in regard to the output and distribution of coal would be withdrawn as far as possible.

So far as the Government is concerned, their position at the moment is that they undertake to make good immediately after the war any modifications that may be made of established rules and practices.

ELECTRIC SAFETY LAMPS FOR MINES

A HOME OFFICE Order, dated June 15th, approves the following electric miners' lamps.

The "Rutter" Miners' Electric Safety Lamp (made by the South Wales Electric Safety Lamp Co., 14 Birch Avenue, Treforest, Pontypridd). According to the official description this lamp, which is approved for general use, possesses the following essential features: A case of pressed steel. An electrical accumulator, the terminals of which are fitted with spiral springs carrying rubbing contacts. The construction of the accumulator is such that the release of gas generated by chemical action is allowed, but no liquid is permitted to escape whatever the position of the lamp. A cover of steel carrying a dome of stout glass protected by steel pillars, and kept in position by a disc of insulating material to which are fitted the bulb-holder and the electrical contacts. The cover forms a flame-tight connection with the case. The switching on and off of the light is effected by turning the cover round about a quarter-turn. A magnetic lock, mounted on the cover, so constructed that the locking bolt can only be withdrawn by a powerful electromagnet.

Among the conditions subject to which it is approved are the

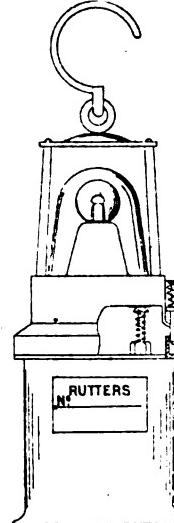


FIG. 1.—RUTTER LAMP.

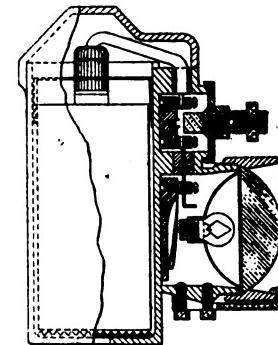


FIG. 2.—OLDHAM
EMERGENCY LAMP.

following:—That the total weight of the lamp is not more than 4½ lb. That the lamp shall be capable of maintaining a light of not less than 1 candle-power all round in a horizontal plane throughout a period of not less than 9 hours, and also of giving a light of not less than 1·5 candle-power over an arc of 45 degrees in a horizontal plane. An illustration of this lamp is given in Fig. 1.

The Oldham "Emergency" Electric Lamp, No. 2 Bull's-eye (made by Oldham & Son, Denton, Manchester). This lamp is a modification of the Oldham "Emergency" electric lamp (see ELECTRICAL ENGINEERING, April 3rd, 1913, p. 187), with the following variations:—The case may be of solid drawn steel or brass. The cover is screwed on and secured by either a lead plug or a magnetic lock. The lens ring is secured by a clip held in position by a screw over which a lead seal is placed. Electrical connection with the accumulator is by means of spring brass contacts with brass studs on an insulator of teak or other non-conducting material. Among the conditions subject to

which it is approved are the following :—That the total weight of the lamp is not more than 6½ lb. That the lamp shall be capable of maintaining a light of not less than 1·5 candle-power throughout a period of not less than 10 hours. That the lamp shall be used by officials only, or for work of rescue or exploration in the case of an accident or other emergency. An illustration of this lamp as originally approved is given in Fig. 2.

The complete list of approved electric safety lamps is given below :—

For general use.—Bristol, Type B.T. 4 V. (Bristol Electric Safety Lamp Works); B.A.C. (British Accumulator Co., Ltd.); "Ceag" ("Ceag" Miners' Supply Co., Ltd.); Turquand-Kingsway (General Electric Co., Ltd.); Gray-Sussmann, Nos. 3 and 4 (W. E. Gray); Manley and Sandy (M. & S.) (Manley & Sandy, Ltd.); Joel-Fors, Type 403 M. (John Mills & Sons); Oldham (Oldham & Son); Pearson (Pearson & Sons, Ltd.); Thomson-Rothwell (Rothwell & Co., The Thompson Co.); Rothwell, No. 3 (J. H. Rothwell & Co.); Rutter (South Wales Electric Safety Lamp Co.); Varta (Tudor Accumulator Co., Ltd.); Wolf, Alkaline, Wolf, Lead, and Wolf, No. 2 (Wolf Safety Lamp Co.); Worsnop (Worsnop & Co., Ltd.).

For use by officials or for special purposes only.—Bristol, Type B.R. 4 V. (Bristol Electric Safety Lamp Works); Float Patent (Float Electric Co., Ltd.); Joel-Fors Electric Inspection Lamp, Type 303 C, and Joel-Fors Electric Hand Lamp, Type 403 H (John Mills & Sons); Oldham "Emergency," Oldham "Emergency," Type No. 2 Bullseye, and "Oldham" Shaft and Roadway, Types "A" and "B" (Oldham & Son); Varta, Type 2 Et 4 (Tudor Accumulator Co., Ltd.); Wolf Rescue, No. 2 (Wolf Safety Lamp Co.).

ELECTRICAL MINING AND METALLURGICAL PATENTS OF JULY

Mining.

In Specification No. 23,348 of 1914, the Allgemeine Elektricitäts Gesellschaft describe a system of enclosed switchgear for mining and other purposes with all live parts immersed in oil or embedded in a cast mass of insulating material arranged so that the several sections can be isolated and removed with safety without interruption of the supply. The gear consists of separate box-like units, each containing a bus-bar section and an oil switch branched therefrom, the connection being made between the bus-bars of the several switch sections and the main cables by removable plug connections.

A system of electrical signalling in collieries is described by H. Green and W. de M. Landon in No. 20,342 of 1914, for enabling men in charge of wagons to signal one to another from any point when a wagon is being sent along the track. There is a single main line of low-voltage normally-closed circuit, and a number of local bell circuits are provided, equipped with suitable relays so that the bells ring when the main circuit is broken. The main circuit is provided at intervals with enclosed spring contacts so that the continuity can be temporarily broken by pulling on the wire itself, and in this way the desired signal can be given from any point.

In No. 18,870 of 1914, G. Pearson describes a simple form of combined battery contact and lamp-holder for electric miners' lamps.

In No. 1,433 of 1915, G. Saint describes a special form of mercury globule contact-maker for releasing and actuating mine winding signal indicators. This consists of a tilting or revolving tube, the bore of which is expanded at the ends and sealed to retain a globule of mercury, which on tilting or rotation of the tube travels from one end to the other, connecting during its passage two terminals in the constricted part of the tube, and thus momentarily completing the circuit when a certain speed is reached.

The Sterling Telephone and Electric Co. and F. G. Bell describe their system of electric signalling for mines in Nos. 13,062 and 18,661 of 1914. The first of this is concerned chiefly with the details of the form of signalling being used. In this key, the operating lever normally rests and returns under gravity to a position from which it is only brought to the operating position by movement substantially opposite in direction to the actual operating or contact-making movement. The second specification describes a simplified arrangement of connections using a smaller number of relays. Each lamp relay transfers the signal circuit to the succeeding relay, and interrupts the hold on contact of the preceding relay.

A simple magnetic lock for miners' electric safety lamps, which takes the form of a self-contained removable padlock, is described by J. Davis & Son, Ltd. (Derby), and W. H. Davis in Specification No. 21,040 of 1914.

Electro-metallurgical.

F. W. Highfield, in Specification No. 6,865 of 1914, describes a process for the reduction of zinc oxide, &c., which consists in feeding the oxide directly on to the glowing surface of a body of electrically-heated carbon maintained at a temperature of about 1,050° C. in an atmosphere of carbon monoxide, maintained as far as possible free from carbon dioxide by exclusion of the air from the heated carbon. The molten zinc produced percolates by gravity through the carbon bed, and is collected and passed into a cooling chamber containing a neutral or reducing atmosphere.

The same inventor in No. 68,607 of 1914 describes a process for recovery of metal from complex sulphide ores, consisting in roasting the charge of ore in a furnace, then forming a reducing atmosphere in the same furnace, and heating the charge by electrical means to obtain reduced metal and matte, separating and cupelling the metal so reduced in an electrically-heated cupelling hearth, and reducing the oxide resulting from the cupellation in a reducing furnace that is also electrically heated.

ELECTRICAL SHOT FIRING FROM THE SURFACE

A SYSTEM of electric shot-firing from the surface in use in a mine in Kansas is described in an article in the *American Colliery Engineer*, abstracted in the *Colliery Guardian*. The two main and one return leads down the mine are connected to a three-pole switch about 30 ft. from the pit bottom, and a 6-foot flexible gap switch is provided some 120 ft. further in the mine as protection against lightning and a safeguard against premature shot-firing. A copper earth-wire extending through the entire mine serves as a protection from accumulated static charges. From the gap switch wires are carried to the "spark boxes," each having its own earth switch. These boxes contain a solenoid and trigger arrangement, by which, when set, the first current impulse received is directed to the local firing circuit and all succeeding ones to the circuit of the next box, which in like manner uses the first impulse to fire its own shots, and hands on the remainder to the next. Thus all the groups of shots are fired in succession.

The shots are fired in the evening after all the men have been checked out of the mine. It is the duty of the shot-firer to fire the shots as well as to see that there are no men in the mine, and also that the wiring, spark boxes, and other apparatus are in good order. Before firing the shots he must go through the mine and connect the shot wires to the spark boxes, and at the same time throw out the earth switch beneath each box. He then comes to the shaft, owing in the 6-ft. flexible gap switch and the three-pole switch, and comes to the surface, where he starts the dynamo, tests the circuit, and fires the shots. The shots are tested by passing a current from a single dry cell through the circuit supplied by each spark box, before the shots supplied by that box are fired. The shots are fired alternately on the east and west sides of the mine. After completing the firing, the shot-firer goes immediately into the mine, opening the three-pole switch and the 6-ft. flexible gap switch, and then he goes to each spark box, and disconnects the firing wires and closes in the earth wire switch. Current of 20 to 30 amperes at 175 volts is used. It is probable that not more than 50 to 75 volts is necessary to produce sufficient pressure to overcome the resistance of the firing circuit; 0·4 ampere is sufficient to explode a fuse; while 0·9 ampere is sufficient to work a box.

Diesel Engines.—At a recent meeting of the Diesel Engine Users' Association the question of a suitable allowance for depreciation of Diesel engine plant in connection with income tax assessment was further considered, and after some discussion the following resolution was unanimously passed :—"That in the opinion of this Association the present allowance made for depreciation by wear and tear on Diesel engine plant by the Inland Revenue Authorities is inadequate, and that an allowance at the rate of at least 15 per cent. per annum should be claimed." This meeting was held at Kingston, where the members enjoyed the hospitality of the Mayor and Mayoress, and had the opportunity of meeting members of the Electric Lighting Committee of Kingston-upon-Thames. A visit was afterwards paid to the electricity works, where the Diesel engines were seen at work. The plant consists of two engines of 400 and 500 b.h.p. respectively, the smaller engine being of the four-cycle horizontal type (four cylinders), and the larger of the two-cycle horizontal type (two cylinders). The next meeting will be held in October. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, 19 Cadogan Gardens, London, S.W.

**QUESTIONS AND ANSWERS
BY PRACTICAL MEN**

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,454.

Two 95-kw. auto-converter are being driven from a 500-volt system, and are supplying current at 300 volts to a motor load. When the machines are paralleled an equalising switch is closed. Until recently, the machines when started up built up to a pressure of 330 volts each and no trouble was experienced in paralleling them; but recently for some unknown reason one machine builds up to 350 volts. The result of this is, the equalising switch is burnt out after the machines have been operated a few times. What is the cause of this rise in pressure on one machine, and what is the best way to locate the fault and remedy it?—"ESTIMATOR."

(Replies must be received not later than first post, Thursday, August 12th.)

ANSWERS TO No. 1,452.

Below are two diagrams of a three-phase star delta starting-switch showing contacts made when in the starting and running positions. Please show connections to motor terminals and mains. In Fig. 2 numbers 1 and 4 terminals are the ends of

Fig.1.

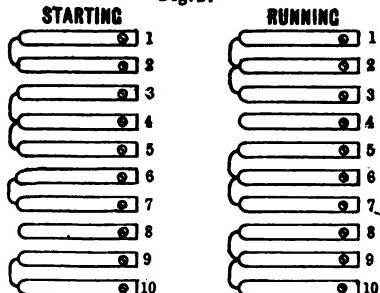


Fig.3.

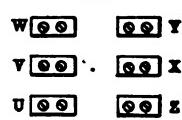


Fig.2.



one circuit as tested by a lamp, also numbers 2 and 5, 3 and 6, two other circuits. The terminals of another motor are lettered as in sketch 3. As received from the makers, the terminals marked X Y Z are short-circuited. Could this motor be coupled to a star delta starting-switch? Why is the lettering of the two top terminals on the right reversed? W and Y are not the

ends of one circuit, as there are 13 megohms between them. Give a diagram showing the connection of the terminals to motor windings.

The first award (10s.) is given to "Y. Z." for the following reply:

The function of a star delta switch, when used in conjunction with a squirrel-cage motor, is to reduce the starting current by reducing the volts per phase at starting. This is done by coupling up the three phases in star at starting, which makes the volts per phase only 57.7 per cent. of the full line volts. After the motor is going the connections are changed so that the three phases are coupled in delta, having therefore the full voltage on them. It is clear that the motor must in this case be designed to work with its phases coupled in delta. Figs. 4 and 5 show the diagram of what happens. M_1 , M_2 , M_3 are the three mains, 1-4, 2-5, 3-6 are the three phases, the numbers corresponding to the terminals between which the question states they are connected. The change from star to delta is made by breaking the star point, and connecting 4 to M_1 , 5 to M_2 , 6 to M_3 . This is accomplished by arranging the connections as shown in Fig. 6, where the numbers of the contacts themselves, shown in the question as 1 to 10, are omitted for clearness, while M_1 , M_2 , M_3 indicate the mains, and T_1 to T_6 show the terminals, numbered as in the question, and connected to the phases as described. The starting and running connections are combined in one diagram, and it will be seen that everything required is accomplished. The two contact bars numbered 4 and 8 in the question, which are shown unconnected to other bars respectively in the two diagrams of the question, are to

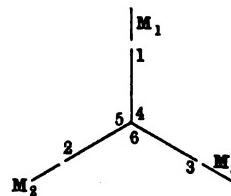


Fig. 4.

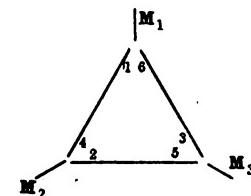


Fig. 5.

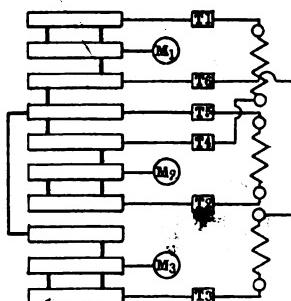


Fig. 6.

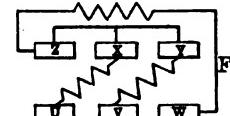


Fig. 7.

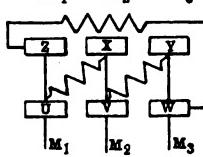


Fig. 8.

be connected together as shown, and are therefore both coupled to T_5 . This answers the first part of the question, as it shows the complete connections of the switch to the motor terminals and mains.

In regard to the second motor, inquired about in the second part of the question, the arrangement of the terminals there indicated is merely a matter of convenience. If U , V , W are the three ends of three phases, the other ends of the same phases, in the corresponding order, are X , Y , Z , i.e., the phases are between UX , XY , YZ respectively, as shown in Figs. 7 and 8. Instead of going straight across between terminals, the phases are coupled zig-zag as indicated, in order that all motors, whether star or delta connected, may have their external mains and phases connected to the terminals in exactly the same manner, and may have the ends of the phases interconnected for coupling to the mains in a much simpler and neater manner than if the terminal arrangement were anything else. For star connection it would evidently, from Fig. 7, be all right to have X opposite U , and so on, as all that is required is to couple together X , Y , Z . But in delta connection, ends of different phases have to be connected, and the arrangement chosen, as shown in Fig. 6, makes it possible to do this very neatly by joining UZ , VX , WY , which are respectively opposite to each other. In this case, if the ends of phases were opposite, the external connections between terminals would have to be zig-zagged and crossed, which would be much less convenient. Thus there is a definite reason, that of simplicity and neatness, for displacing the terminals each one place along on one side (which is a more correct way of putting it than to say that the lettering is reversed, though this also is incidentally a fact).

The motor referred to is evidently connected, as in Fig. 7, with XYZ connected together. It is therefore a star-connected

motor, and Fig. 7 is the diagram of connections between terminals and windings asked for. This motor would not be correctly used if coupled up to a star delta starter. For, as has already been made clear, the running condition of a motor so used is that the phases work delta connected. But this motor is meant to work star connected, and if put on the mains delta connected would have full volts on each phase. This is 1.73 times too many volts per phase obviously, and the motor would be entirely upset in all its constants. It must therefore be started by using an auto-transformer. It is assumed, of course, to be squirrel-cage.

The second award (5s.) is made to "J. E. R. R." who writes as follows:—

The diagrams show the several connections desired. Figures 9 and 10 show the connections of the start delta starting switch for star and delta positions. The small diagrams underneath show how the switch connects the phase ends. The arrows show the direction of the currents at one particular instant. It will be seen that at the same instant the directions are the same for star or delta positions, which ensures the direction of the field to be the same. This is an important point in coupling up any star delta starting switch, as if a phase be crossed the direction may be different in delta from that in star, with the result that serious damage may be caused in the motor when switching over. It will be seen that in addition to the line and motor connections an additional permanent connection is required between contacts 4 and 8 on the switch.

Figures 11 and 12 show the probable coupling of the phase ends of the motor in Figure 11 of the question, as it is usual

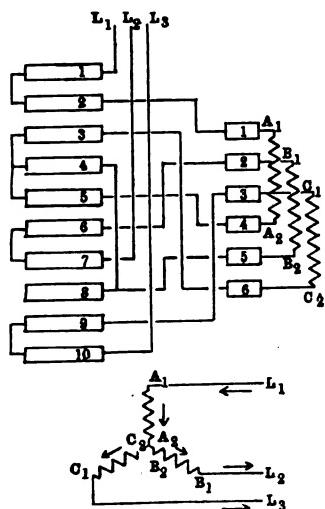


Fig. 9.

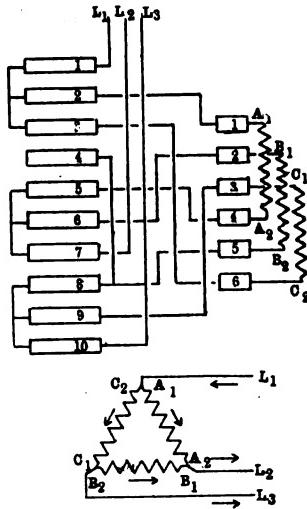


Fig. 10.

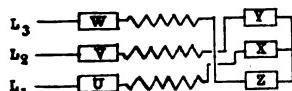


Fig. 11.

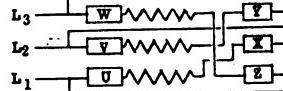


Fig. 12.

to letter the phase ends in alphabetical order respectively. The lettering of terminals X and Y are reversed, so as to indicate the right phase ends. The order of bringing out the phase ends may have been changed for one or two reasons. It may be more convenient, or mean less cable inside the motor, but the most probable reason is that it makes a very simple connection whether motor is coupled star or delta. It will be seen that to couple the phases up star it is only necessary to couple the terminals on one side together, whilst for delta it is only necessary to put connectors across, coupling the terminals in pairs. The figures show how such a motor could be coupled up star or delta. It could be coupled up to any star delta starting switch, using U V W as phase ends, with X Y Z as the other ends respectively. It could be controlled with the starting switch in Figures 9 and 10 if the phase ends U V W are connected to terminals 2, 6, and 9 and phase ends X Y Z to terminals 5, 8, and 3 respectively, and of course the permanent connection made between terminals 4 and 8, the line terminals being the same.

It should be borne in mind that as the makers delivered the motor coupled star it may be designed to run on its normal voltage star connected. If so, running it delta connected on full voltage would be equivalent to 73 per cent. increased voltage across each phase winding, which would probably burn the motor out on load. If it is in doubt as to what the normal running connection should be, then a test should be taken by running the motor light, star connected. If when so connected the light load current is about 30 per cent. of the normal full load current, then it can be assumed that its normal connection is star; but if the light load current is about 10 per cent. of the full load current, then the normal connection is delta.

CORRESPONDENCE

QUESTION 1,551. PLATING DYNAMOS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—There is a much better practical solution to the problem of multiple-voltage dynamos for plating than either of those given by your prize-winners in the current issue of ELECTRICAL ENGINEERING. It should be said, in justice to them, that the potential requirements of plating are a number of definite voltages, corresponding to the metals to be deposited, and not that of regulation between certain limits, as propounded by the question.

The practical solution referred to was given by Mr. W. B. Sayers a good many years ago, when he designed and patented the device of forming several non-sparking brush positions by slotting the pole pieces at appropriate places, so that brushes carried at the corresponding commutator radii give different calculated voltages in reference to brushes carried at the normal commutating diameter. A good many of these machines were made by Messrs. Chamberlain & Hookham and sold in the Birmingham district. They could be used for two or three baths, say nickel and silver, or copper silver and gold, simultaneously—which your prize-winners' plans could not—and were very successful. I cannot say whether such machines are still on the market. The device has other applications, e.g., a third brush may be used to give an exciting voltage, where a shunt-wound machine is required of such size and voltage that the shunt-winding would be of inconveniently fine wire if calculated for the main voltage. This arrangement is particularly suitable for small motor-generator sets off 440 volt or traction supplies, and is quite successful in practice.

Streatham, S.W.
July 30th, 1915.

I am, Yours, &c.,
HENRY M. SAYERS.

ELECTRIC TRACTION NOTES

The following dividends have been announced by the group of railways in London affiliated to the Underground Electric Railways Co. of London, Ltd.:—London Electric Railway, full dividend on the 4 per cent. preference stock and 1 per cent. on the ordinary; Metropolitan District Railway, full dividend on the 4 per cent. guaranteed stock, 4½ per cent. on the first preference stock, and 3 per cent. on the second preference stock; Central London Railway, 8 per cent. on the undivided ordinary stock and 4 per cent. on the preferred ordinary stock; City & South London Railway, 5 per cent. on the 1891, 1896, 1901, and 1903 preference stocks.

The *Electrical World* (New York) has collected a number of statistics regarding the cost of running of electric commercial vehicles in actual regular service. The average figures of the total cost of running per vehicle per day, including interest, depreciation, &c., work out as follows:—700 lb. load, \$5.68; 1,000 lb. load, \$6.84; 2,000 lb. load, \$7.56; 4,000 lb. load, \$8.92; 7,000 lb. load, \$10.88; 10,000 lb. load, \$11.74. The average daily mileage of these vehicles is not given.

Some particulars of the new electric locomotives which are being made by the American General Electric Co. for the Chicago, Milwaukee, and St. Paul Railway are given in the *General Electric Review*. These are of the 4-16-4 articulated type with four trucks and two bodies, and are equipped with eight 375 h.p. (continuous rating) wound for 1,500 volts D.C. and connected two in series on the 3,000 volt line. The total weight is 520,000 lbs., of which 400,000 lbs. is on the drivers. The passenger and freight locomotive will be similar except for their gear ratio. The passenger locomotive will haul a 300 ton train at 60 m.p.h. on the level and haul a 600 ton train up 20 miles at 2 per cent. up-grade, and the freight locomotive will deal with trains up to 2,500 tons, and will exert a tractive effort to 85,000 lbs. at 15-25 m.p.h. Each motor drives through a twin gear connected to the axle through springs. Regenerative braking is provided for, and a new form of pematograph collector with a double bow contact. Each half of the complete locomotive can be used separately if desired.

The Wolverhampton Corporation Tramways last year contributed to the relief of rates £3,744, equal to a 2½d. rate. The reserve and renewals fund now stands at £53,987, which is the maximum allowed, being one-fifth of the capital expenditure.

Manufacture of War Material in American Electrical Works.

The *Elektrotechnische Zeitschrift* of July 22nd contains a bitter attack on the American General Electric and Westinghouse Co.'s, who are, it is stated, manufacturing war material on a large scale for the Allies.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published July 29th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

26,899/13. **Electrolytic Meters.** H. S. HATFIELD and CHAMBERLAIN & HOOKHAM, LTD. The use of rhodium metal or alloys for the electrodes of electrolytic meters to obtain more accurate proportionality between the gas given off and the current than with platinum.

2,214/14. **Wireless Telegraphy.** R. GOLDSCHMIDT. A multiple spark gap for wireless telegraphy, comprising a taper plug carrying electrodes, a socket carrying an equal number of electrodes on its inner surface, and having the same taper as the plug, the two sets of electrodes being arranged in staggered order, so that each plug electrode is partly overlapped by two on the socket and vice versa. (Three figures.)

9,110/14. **Incandescent Lamps.** C. GLADITZ. Metal filament lamps in which the filament is wound on and supported by a structure composed of beads of silica strung on a wire of tungsten or other refractory material. (Four figures.)

16,471/14. **Telegraph Relays.** EASTERN TELEGRAPH Co. and J. B. DAVIES. Cable relays, including a suspended or pivoted contact arm carrying a very fine wire adapted to make and break contact with a liquid electrolyte, so that the moment of the capillary pull of the liquid upon the conductor is so reduced as to be negligible compared with the moment of the force due to the received signal. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: WATERS and CALLENDER'S CABLE & CONSTRUCTION Co. [Cable joints, &c.] 13,933/14.

DYNAMOS, MOTORS AND TRANSFORMERS: SIEMENS-SCHUCKERTWERKE GES. [Braking single-phase motors] 299/14; PARSONS [Cooling generators] 16,986/14; ECKMANN [Winding motors] 17,037/14; JUHLIN [Ventilation of dynamos] 18,281/14.

Electrometallurgy and Electrochemistry: MARKS (*Siemens & Halske A.G.*) [Lead anode] 284/14; F. KRUPP A.G. [Electrode furnaces] 742/14; PLANCQ [Electrolytic apparatus] 21,727/14.

Ignition: TISMER [Sparkling plugs] 9,444/14; WILSON [Ignition and lighting generators] 16,737/14.

Incandescent Lamps: LUDECKE and BRIMSDOWN LAMP WORKS, LTD. [Filament supports] 27,157/13; B.T.-H. Co. (A.E.G.) [Sealing in] 1,056/14.

Instruments and Meters: SCHOELLER & Co. [Combined ammeter and voltmeter] 27,473/13; B.T.-H. Co. (G.E. Co., U.S.A.) [Meters] 16,869/14.

Switchgear, Fuses, and Fittings: CACHA [Locking lamp-holder] 900/14; DIRKS [Lift switches] 9,289/14; WEST [Controllers] 14,294/14; SMITH and LOACH [Lamp-holders] 16,149/14.

Telephony and Telegraphy: BARON (*Aldendorf*) [Telephone switching systems] 27,515, 28,291, & 28,833/13; ALDENDORF [Telephone switching systems] 28,362 & 28,502/13; VON ARCO and MEISSNER [Wireless transmission] 29,946/13; BARON (*Heimann*) [Automatic telephones] 450/14; SIEMENS & HALSKE A.G. [Automatic telephones] 459/14; RELAY AUTOMATIC TELEPHONE CO., BRYANT and WARD [Automatic telephones] 16,411/14; HEYLAND [High-frequency generator] 17,331/14; CONNER and ROBINSON [Telephone systems] 17,446/14; SIEMENS BROS. & Co. (*Siemens & Halske A.G.*) [Automatic telephones] 21,793/14.

TRACTION: VON KANDO [Electric vehicles] 963/14; JOHNSTON and GREEN [Trolley heads] 3,318/14.

Miscellaneous: KRAUSE [Separating dust from gases] 27,059/13 and 27,060/13; MOORE LICHT A.G. [Vacuum light apparatus] 27,426/13; ROMANES [Contact cramps] 27,590/13; CONWAY [Insulating gloves] 16,111/14; BANNEVER [Alarms] 16,597/14; BENDIXEN [Fire alarms] 17,611/14; GRINSTED [Production of intermittent currents] 1,007/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

IGNITION: DAIMLER MOTOREN GES. [Sparkling plugs] 9,783/15.
TELEGRAPHY: SRNKA [Telegraph systems] 10,228/15.

Amendments

29,712/13. **Wireless Telegraphy and Telephony.** R. C. GALLETTI and GALLETTI'S WIRELESS TELEGRAPH CO. A request for correction of clerical errors in this specification has been made. The system of transmission described depends for its control on the variation of a resistance in a shunt circuit in parallel with a part of a series multigap discharger.

4,082/13. **Electrolysis.** C. WHITE. Slight alterations have been allowed in the wording of this specification, which describes an electrolytic process for the preparation of oxides, hydrates, and other components of metals.

Opposition to Grant of Patents

4,655/14. **Motor Car Lamps.** A. CHRISTMAS. A grant has been allowed in this application in spite of opposition. The specification describes a system in which the lamps are fed from an ignition magneto through inductances contained in the lanterns.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:-

15,819/01. **Battery Ventilation in Submarines.** R. McA. LLOYD. A method of providing egress for gases evolved on charging of accumulators in submarines, etc., by a pipe connected to the closed battery box with a valve for shutting off when required and means for providing suction in the pipe to sweep out the gases by drawing air into the battery box by a non-return valve and not through the pipe.

16,062 and 16,063/01. **Magneto Ignition.** F. R. SIMS and R. BOSCH. Constructive details of an improved form of sparking plug for low tension break-spark magneto ignition.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, AND TRANSFORMERS: ELEKTRICITÄTS A.G. vorm. W. LAKMEYER & Co. [Dynamo regulation and motor control] 5,977/05, and [Train-lighting dynamos] 8,526/06; C. J. SPENSER and J. W. DAWSON [Variable gauge tramcar trucks] 8,959/06; SIEMENS BROS. DYN. WKS. and KIEFFER [Communicators] 8,133/08.

Electrochemistry and Electrometallurgy: G. W. J. ALLEN [Electrolytic water preparation] 9,002/06.

IGNITION: H. W. HELLMANN [Magneto ignition] 8,858/02.

INCANDESCENT LAMPS: A. G. BLOXAM [Metal filaments] 9,020/06; B.T.-H. Co. (G.E. Co., U.S.A.) [Attachment of filaments to leading-in wires] 8,641/07.

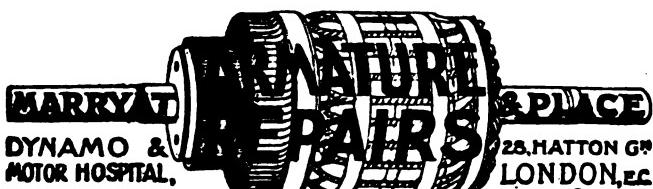
TRACTION: B.T.-H. Co. (J. B. LINN) [Multiple unit control] 8,557/02; F. H. HIGLEY [Railway signalling] 8,421/04.

Engineering Institutions Volunteer Training Corps.—A card is being issued calling attention to the objects of the Corps, which it is hoped that employers will display on their notice boards or other prominent position. It is desirable that members of all branches of engineering, not only electrical, shall be included in the Corps, and the Commandant will be glad to receive applications for enrolment at Marconi House, Strand, W.C. The following is the constitution of the General Committee:—Mr. L. B. Atkinson, Mr. B. Hall-Blyth (President, Inst. Civil Engineers), Lt.-Col. C. B. Clay, V.D. (Commandant), Col. R. E. B. Crompton, C.B., R.E., Mr. E. G. Fleming, Sir John Gavey, C.B., Dr. R. T. Glazebrook, C.B., F.R.S., Major Henrici, R.E., Mr. J. S. Highfield, Prof. Bertram Hopkinson, F.R.S., Sir Alexander Kennedy, F.R.S., Col. A. M. Ogilvie, Lt.-Col. A. E. Le Rossignol, R.E., Mr. P. F. Rowell (Sec., Inst. Electrical Engineers), Mr. Alexander Ross (President-Elect, Institution of Civil Engineers), Dr. Alexander Russell, F.R.S., Capt. H. Riall Sankey, R.E., Mr. C. Sparks (President-Elect, Institution of Electrical Engineers), Sir John Snell (President, Institution of Electrical Engineers, Hon. Commandant), Dr. J. H. T. Tudsbury (Sec., Inst. Civil Engineers), Prof. W. C. Unwin (President, Inst. Mechanical Engineers), and Mr. E. Worthington (Sec., Inst. Mechanical Engineers).

The Ediswan Works.—Mr. F. Carrodus, Science Master of King's College School, Wimbledon, with a party of Students visited the Ponders End Works of the Edison & Swan United Electric Light Co., Ltd., on Thursday, the 29th inst. Both the engineering and "Royal Ediswan" lamp-manufacturing sections were visited.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Before the Royal Society of Arts on Wednesday last week, Mr. C. R. Darling (Lecturer in Physics and Electrical Engineering at the City and Guilds College, Finsbury), gave a lecture on trench telephones. The present war, he said, had been rightly called a telephone war. Since the East began to teach the West, and the Japanese in their war with Russia showed the potentialities of the telephone in large-scale warfare, everyone was aware that in any future war telephones would play a very important part, but probably no one suspected that they would assume the importance they had in the present conflict. Flag-signalling had practically been abolished, and all communications were carried on by telephone. The bell had also been abandoned for calling purposes and the buzzer substituted, for the reason that frequently during the noise of the fighting speech was impossible, but by means of the buzzer communication was maintained by Morse signalling. The buzzer which was most popular for field purposes was known as the D Mark III., which by reason of being constructed with two electro-magnets working in conjunction with a pivoted reed vibrating at both ends gave a clearer note for Morse signalling purposes than the buzzer with a reed vibrating at only one end. Nevertheless, owing to the demand for instruments, many of the latter type of instrument were in use. The total weight of the D Mark III. outfit, including two dry cells and leather case, was 8lb., and as a measure of precaution against interruption it was provided with two receivers, one an ear-piece with strap for fastening round the head of the operator, and the other a combination receiver and transmitter. Dealing with the lines used for field work, the lecturer pointed out that for temporary work a single strand iron wire is used, merely varnished for insulation. This is usually abandoned when communication is no longer needed. For more permanent work a steel wire consisting of several strands was used, with better insulation than in the case of the single-strand iron wire. Steel was used on account of its greater strength compared with copper. Dealing with some of the difficulties in maintaining communication due to wires being broken from various causes, Mr. Darling mentioned some of the devices for mitigating the inconvenience so caused. A good many attempts had been made to devise some system of multiple lines, and one idea introduced by the French is to lay the wires practically in the form of a ladder. In other words, two lines are laid more or less parallel between the transmitting and receiving stations connected across at frequent intervals in the form of rungs. These rungs—the more the better—naturally vary considerably in length, but the object is to maintain communication even if the circuit is broken in several places, and this plan is found to achieve that object, there being practically always at least one path open for the current. Meanwhile, repairs can be carried out. Another plan is to locate a telephonist in a dug-out approximately half-way between the two stations and to carry three or four wires through this dug-out. By continual testing the operator in the dug-out is able to ascertain which line is broken, and by connecting up the sound wires on either side is able to maintain continuous communication whilst repairs are attended to. In conclusion, the lecturer emphasised the great need for a further supply of telephonists for the Front, and also the absolute necessity that such men should be thoroughly trained in the technical side. With this object in view, he suggested that all teachers of physics and electricity should offer their services to the Government, so that a co-ordinated scheme for training men as telephonists could be evolved and an ample supply of trained operators provided. At present the number available was not that which might be desirable.



TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Bury.—The Corporation proposed to spend £7,500 upon new plant at the electricity works.

Erith.—The scheme of extensions drawn up by the Borough Engineer has been sanctioned by the Council.

Falkirk.—A new sub-station is to be constructed by the Council.

Manchester.—A third converter is to be installed at the London Road sub-station.

Watford.—A loan of £1,560 for mains is to be applied for.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Blackpool.—Mineral water factory. E. Kay.

Bury.—Weaving shed. Elton Cop Dyeing Co.

Cardiff.—New police court, Pontardawe. Clerk, County Hall. August 12th.

Chorley.—Council school.

Derby.—A loan of £4,500 has been sanctioned for extensions to the Free Library and Art Gallery.

Glasgow.—Electrical installation at Govanhill public baths. Town Clerk. August 12th.

Leeds.—New central technical school.

Salford.—Rebuilding warehouse. Davies & Co., Hutchinson Street.

Sheffield.—Extensions City Hospital, Crimicar Lane. City Architect.

Southport.—Hospital. Architects, Bolshaw, Packer, Peach & Prescott.

Swansea.—Hospital (£50,000).

Tonbridge.—Post office (£9,000).

Wigan.—Cinematograph theatre. William Well, King Street.

Miscellaneous

London: *H.M. Office of Works.*—Twelve months' supply of electric incandescent lamps. August 13th. (See an advertisement on another page.)

Manchester.—Arc lighting in Piccadilly.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Leith.—The Corporation has placed a contract with Siemens Bros. Dynamo Works for a twelve months' supply of tantalum and traction lamps.

Redditch.—The following tenders have been received for a H.T. three-phase switchboard in connection with the extension scheme now being carried out under Messrs. Handcock & Dykes:—Bertram Thomas, £1,875 10s. (accepted); Electric Construction Co., £1,892 14s.; British Westinghouse Co., £1,998 14s.; General Electric Co., £2,090; Switchgear & Cowans, £2,191; British Thomson-Houston Co., £2,223 14s.; Ferguson, Pailin & Co., £2,239 14s.; Johnson & Phillips, £2,274 10s.; Edison & Swan Co., £2,297 11s.; Park Royal Engineering Works, £2,400.

Worcester.—The Corporation are to purchase two Erith Riley patent stokers at £775, and an Edison 3-ton battery tipping lorry at £941.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £86 10s. to £87 10s. (last week, £88 to £89).

Agencies.—A firm inquires for the names of United Kingdom manufacturers of dynamos, motor starters, switches, and

lamps, desirous of being represented in Australia.—A firm of iron and steel merchants in Montreal wishes to secure the representation of United Kingdom manufacturers of steel tape to be used in connection with electric cables.—An Italian firm wishes to represent United Kingdom manufacturers of electrical measuring instruments and other electrical apparatus in use in dockyards, on tramways, &c. Further particulars at 78 Basinghall Street, E.C.

Liquidations.—The creditors of the Consolidated Diesel Engine Manufacturers, Ltd., will be paid in full on August 17th at General Buildings, Aldwych, London.

A petition for the compulsory winding up of the Adnil Electric Co., Ltd., will be heard in the Chancery Division of the High Court on October 19th. The petitioners are the Acme Electrical Manufacturing Co., of Tottenham.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. Wright, District Engineer in the Auckland area of the Cleveland & Durham Electric Power Co., has been presented with a case of drawing instruments and a case of pipes on his departure to South America, where he will take up the position of Mains Engineer with the Argentine Railway Co.

On the eve of departure for Australia, Mr. W. A. Holmans, a member of the staff of the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), for over sixteen years, was presented by the staff with a diamond ring, a cabin trunk, and a pocket-book. Mr. Holmans is to be stationed in the Ediswan showroom at Melbourne.

The names of about 250 of the staff of the County of London Electric Supply Co. and Associated Companies who have joined the Forces, of whom already four have lost their lives for their country, are contained in a Staff War Bulletin, in which some interesting extracts of letters from the Front and other notes are published.

Private A. Hotz, of the Construction Department of the British Thomson-Houston Co., has been decorated with a Distinguished Conduct Medal for conspicuous gallantry on Hill 60, when he placed himself in front of a communication trench occupied by the enemy, and, on the enemy advancing, attacked them with hand grenades and dispersed them.

In June the Nuneaton Council succeeded in persuading their Electrical Engineer, Mr. R. N. Mayne, from joining the Forces on the ground that he was urgently needed to carry through an important scheme of extensions. Last week Mr. Mayne asked for an increase of £150 per annum in salary, but by nine votes to four the Council confirmed a refusal of the Electricity Committee to grant the application.

The late Major Flood-Page, a director of Marconi's Wireless Telegraph Co., left estate valued at £5,671.

Mr. P. H. Fox has been appointed Chief Electrical Engineer at Musselburgh at a commencing salary of £215 per annum.

Mr. H. A. Ratcliffe, head of the testing department of the Manchester electricity undertaking, has been appointed a member of the Manchester Air Pollution Advisory Board.

An electrician is required for a permanent position in London. (See an advertisement on another page.)

LOCAL NOTES

Bristol: Criticism of Electricity Department.—Notwithstanding the satisfactory results of the past year's trading of the electricity undertaking, as reported on p. 326 of our last issue, there is still criticism of the department. At the last meeting of the Corporation, when the accounts were adopted, Councillor Witty described the undertaking as a colossal financial failure, and urged the appointment of an expert to report upon the undertaking. Having failed in this, he has given notice of his intention to move the recission of the resolution adopting the accounts.

Greydon: Satisfactory Year's Working.—The auditors of the Electricity Department's accounts recommend that the net profit of £2,595 on last year's working, together with £2,284 brought forward, be transferred to the reserve and renewals fund.

Glasgow: Cost of Coal.—During the discussions in the House of Commons upon the Government Bill for limiting the

price of coal, several references were made to the extra expense incurred by the Glasgow Corporation upon its coal purchases. These were no doubt inspired by Bailie W. B. Smith, Convener of the Electricity Committee, who, together with other municipal representatives, has been in London for about a fortnight in connection with this matter. The Glasgow Corporation contracts, having been entered into since April 30th, now come within the scope of the Bill, with the result that the Electricity and Gas Departments alone will save some £60,000 of the price they would otherwise have had to pay. The average increase in price was 5s. 3d., whereas under the Bill it cannot be more than 4s. There was a deficit of £459 on last year's working of the electricity undertaking. We have already reported the decision to add 15 per cent. to all accounts.

Manchester: Proposed Investigation Committee.—The agenda for yesterday's meeting of the Corporation contained a notice of motion by Councillor Ross C. Clyne for the appointment of a Special Committee to inquire into the working of the electricity undertaking, this Committee to appoint an independent electrical engineer to advise it. It is also proposed to hear evidence from ratepayers as to their views upon the present policy of the department. The motion seems to point to a continuation of the hitherto abortive efforts to prevent the Barton power scheme being proceeded with during the period of the war.

Southampton: Proposed Increase in Charges.—There have been many discussions regarding charges for some time past, quite irrespective of the war, and it is not altogether surprising that some change should be made. For private lighting consumers the charge for the first 50 units is to be 3½d. per unit instead of 3d., the charge for consumption above that remaining at 2½d. per unit; for business premises the charge is to be increased from 3d. to 3½d. per unit; for supply outside the borough, 3d. instead of 3d.; and for heating and cooking, whether inside or outside the borough, 2d. per unit instead of 1d. A simpler scale than at present in use for power purposes is to be drawn up. No alteration is to be made in public lighting or traction. There was a lively discussion on these proposals at the meeting of the Corporation on Wednesday last week, the Electricity Committee being admittedly not unanimous. There was a section who preferred a 10 per cent. increase all round rather than dealing with each class on its merits. However, the above scheme was eventually adopted, and thus the Point-Five Association loses a member.

Sutton Coldfield: Loan Refusal.—The Local Government Board has refused the loan of £2,500 applied for recently by the Council. The Chairman of the Electricity Committee has drawn up a special report on the matter, which has been forwarded to the Board.

West Ham: Workman's Compensation Claim.—A case has just been decided in the Bow County Court in which a workman in the West Ham Corporation Electricity Department has been awarded £350 in respect of injuries sustained by electric shock whilst cleaning out a transformer sub-station. The hearing of the case occupied three days, and it appears that after the accident the man was paid full wages, 37s. 6d. per week for ten weeks, after which it was suggested he was in a condition to do light work. Evidence was called on his behalf, however, to the effect that he could not carry out work of the character he had been used to, whilst the Corporation called evidence to prove the contrary. Eventually the Court made the award mentioned above.

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(Established 1884)

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Displayed Advertisements, *Tuesday first post.*

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SUMMARY

MR. ROBERT HAMMOND, the well-known pioneer of electricity supply, died on August 5th after a short illness (p. 336).

SOME notes on the half-watt lamps from a recent issue of the *Elektrotechnische Zeitschrift* indicate the lines of the most recent developments in this connection in Germany (p. 336).

GERMANY's "mobilisation" of copper formed the subject of an article in the *Elektrotechnische Zeitschrift* of July 29th, which we review at some length (p. 337).

A CONTRIBUTION to the *Journal* of the Institution of Electrical Engineers by Mr. N. W. McLachlan describes an investigation into the magnetic behaviour of iron under alternating magnetisation of sinusoidal wave-form (p. 337).

WE outline the programme of the British Association meeting at Manchester in September (p. 337).

A PROBLEM connected with the arrangement of the excitation circuit of D.C. machines is discussed in our Questions and Answers columns (p. 338).

REVIEWS and particulars of recently published technical books appear on p. 339.

AMONG the subjects of specifications published last Thursday at the Patent Office are electrical dust precipitation, metal-filament lamps, electric locomotives, safety appliances, and high-frequency alternators (p. 340).

LONDON electrical wiremen have been granted an increase of 1½d. per hour on wages (p. 340).

THE electrical equipment of a cement works is described in an illustrated article (p. 341).

THE Johannesburg Council requires two 3,000-kw. turbo-alternators; generating plant is required at St. Helens (£15,000); Chesterfield (£15,200); Leyton (£18,158); and Bootle. An installation is required for the Earby Sewage Disposal Works; motor for the Nelson Sewage works, and the bulk supply scheme at Lytham is to be carried through (p. 342).

AN attempt to secure the resignation of the Belfast City Electrical Engineer has failed.—The Waterford scheme is to be postponed.—Several towns are finding themselves short of capital for laying mains; and new loans are not easily forthcoming (p. 342).

A NUMBER of London supply companies have declared interim dividends (p. 343).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING AUGUST 21ST, 1915.
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, Wednesday, and Friday:—Drills 6.30 and 7.30.

(There will be no drill on Monday, August 14th.)

Applications for Enrolment:—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING.

(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

The General Committee of this Corps includes the names of many of the prominent members of the three principal branches of engineering, and among them we note the Presidents, and also the Secretaries, of the Institutions of Civil, Mechanical, and Electrical Engineering. The Corps has not only the hearty support of the heads of the engineering profession, but is warmly supported by General Sir O'Moore Creagh, V.C., G.C.B., G.C.S.I., the General advising the Central Association V.T.C.

To enlarge the usefulness of the Corps, further recruits can be accepted either from among the membership of the Institutions or from others who are willing to be trained in fortress engineering work under the staff of the London Electrical Engineers (T.F.) at their Headquarters in Westminster.

The Japanese and Australian Trade.—Attention is called by H.M. Trade Commissioner for Australia to the endeavours which the Japanese are making to capture the trade there in glassware for electrical fittings, insulators, &c., formerly to a large extent controlled by Germany. It is regarded as significant that the Yokohama Specie Bank is about to open a branch at Sydney. There seems to be a strong probability, owing to British firms being engaged in making munitions, that much of the Australian trade hitherto done with enemy countries will meanwhile find its way to countries not directly involved in the war.

OBITUARY

ROBERT HAMMOND.

A VERY well-known figure in the electrical world has been removed by the death, on Thursday, August 5th, of Mr. Robert Hammond, at the age of sixty-five years. It was only about a month ago that he showed signs of illness, but during the past fortnight or three weeks he had been seriously ill with cerebral thrombosis. His death has come as a shock to a very large number of friends, both in the electrical industry and in the political circle, in which he was also well known and esteemed. On the last public occasion that we met him, at the annual meeting of the Institution of Electrical Engineers, he still showed all that virility and animation which were so characteristic of him throughout his career, and there appeared to be no indication then that his health was giving way. The funeral took place at the Golders Green Crematorium on Monday.

Mr. Hammond was, in the fullest meaning of the term, one of the pioneers of the electrical industry in this country, having established himself in it before the passing of the Electric Lighting Act of 1882. Few men can lay claim to such a variety of practice, for in turn he played a conspicuous part in the introduction of the Brush arc machine, in the installation of electric lighting undertakings in numerous places in Great Britain and abroad, in some cases as contractor but in the majority as consulting engineer. His interests extended to tramways, both as consulting engineer for their installation and as arbitrator in fixing charges for current, he was one of the first to moot the possibility of generating electricity on the Rand on a large scale, and he was associated with the first schemes of the London County Council for dealing with the supply of electrical energy in the County of London and surrounding area. He was also retained by the Postmaster-General in connection with the acquisition of the business of the National Telephone Co. His reputation as an expert witness, especially in the Parliamentary Committee Rooms, in connection with municipal electric lighting and tramway schemes, was of the highest. As consulting electrical engineer to municipalities he enjoyed an extremely large practice from the early years of the industry until the day arrived when almost every town of any size had been provided with a supply of electrical energy. Indeed, to this day many of the older-established electricity works are commonly spoken of as "Hammond" stations. A few years ago his son, Mr. R. W. Hammond, was taken into the firm, and the consulting practice was continued under the style of Robert Hammond & Son.

In the early days Robert Hammond was also active in promoting facilities for the training of electrical engineers, first in 1884 at the Hammond College in Hanover Square, a scheme which later developed into the Electrical Standardising Training and Testing Institution (Faraday House), of which he was the founder in 1890. Since 1902 he has been well known to many of our readers as treasurer of the Institution of Electrical Engineers, the financial destinies of which were in his capable hands during the trying period when its new home on the Embankment was being secured. His cheery optimism and ready humour have brightened many an Institution meeting, but it is not so well known that the Institution owes him a deep debt of gratitude for hard and even more useful work on the Council and in Committee.

At the funeral, the following gentlemen represented the Institution of Electrical Engineers:—Sir John Snell (*President*), Messrs. A. Siemens and W. M. Mordey (*Past Presidents*), Messrs. F. Gill and A. M. J. Ogilvie, and Dr. A. Russell (*Members of Council*), Messrs. H. W. Couzens, G. W. Spencer Hawes, F. Ince, J. E. Kingsbury, E. A. Nash, A. H. Preece, J. Rider, H. M. Savers, S. Sharp, A. M. Sillar, A. A. C. Swinton, H. W. Wilkinson, and W. Wyld (*Members*); and

the following wrote regretting inability to attend:—Messrs. W. A. Chamen and R. A. Chattock, Sir William Crookes, Col. R. E. Crompton, Messrs. W. B. Esson, J. S. Highfield, and H. Hirst, Prof. T. Mather, Messrs. S. Morse, G. W. Partridge, W. H. Patchell, H. Faraday Proctor, R. T. Smith, C. H. Wordingham, and P. F. Rowell (*Secretary*).

The death occurred recently of Mr. J. C. Gill, Electrical Engineer to the City of Peterborough.

SOME NOTES ON HALF-WATT LAMPS

THE *Elektrotechnische Zeitschrift* of July 22nd, 1915, contains some notes on the behaviour of half-watt lamps by Dr. K. Mey, of the A.E.G. He points out first that it requires more energy to bring a filament to the same temperature in nitrogen than *in vacuo*, so that the better efficiency is only attained by using a much higher temperature. The filament burns out, however, owing to rapid vaporisation unless it is spiralled or arranged in some other way to occupy only a small space so as to limit its capacity of giving off heat to the gas, when only a moderate increase in temperature is necessary to make up for the loss of heat; and it is found that the permissible rise in temperature corresponds to a lamp efficiency of 0·65 watt per mean spherical Hefner c.p. A 110-volt Hefner c.p. lamp has a filament spiral about 145 mm. long and 0·62 mm. diameter, and emits 10·7 Hefner c.p. per sq. mm. surface, and the gas in it is at two-thirds atmospheric pressure. The efficiency based on the mean hemispherical candle-power (without lantern or reflector) is 0·5 watts per Hefner c.p., and it is estimated that the loss of about 7 per cent. by obscuring the globe is just about compensated for by the use of an outside reflector.

In the article an interesting curve is given to show the dependency of candle-power and efficiency on voltage, and it appears that the variation is in about the same proportion as that of an ordinary tungsten lamp. A 5 per cent. drop in voltage reduces the candle-power by about 15 per cent., but the watts per candle only increases from 0·5 to 0·55. A 5 per cent. increase in voltage sends the candle-power up about 20 per cent., and reduces the watts per candle to about 0·45. At 10 per cent. below normal voltage the candle-power is still nearly 75 per cent. of the normal, and the watts per c.p. about 0·62.

Results of oscillograph experiments to ascertain the current rush on switching on are also given. The momentary current is eight to nine times the steady current, as the resistance of the filament when cold is 1/10th that when hot. The maximum value of the current lasts less than 1/100th of a second, however, and the current drops to normal in 1/5th second. These figures seem to be more or less of the same order as with ordinary tungsten lamps.

The same issue of the *E.T.Z.* contains, in its advertisement columns, a complete list of 100–130 and 200–250 half-watt lamps of a well-known German make; the range is the same for both voltages, there being seven sizes between 150-watt and 1,500-watt inclusive, but the candle-powers vary. Both mean spherical and horizontal candle-powers are given. In no case does the former reach $\frac{1}{2}$ watt per c.p., and the horizontal c.p. only reaches $\frac{1}{2}$ watt per c.p. (Hefner) in the larger sizes. The 150-watt 100-volt lamp has a horizontal c.p. of 240 Hefner, and the 200-volt lamp of the same wattage only 200 Hefner, i.e., 0·75 watt per Hefner c.p.

A State Research Council.—The Board of Education has issued particulars of its scheme for the organisation and development of scientific and industrial research which was discussed some time ago in the House of Commons in connection with the Educational estimates. The scheme is to have a permanent organisation of a national character which will have complete liberty to utilise the most effective institutions and investigators available. For this purpose there is to be established a Committee of the Privy Council responsible for the expenditure necessary and a small Advisory Council consisting of scientific men and men actually engaged in industries dependent upon scientific research. The Committee will consist of the Lord President, the Chancellor of the Exchequer, the Secretary for Scotland, the President of the Board of Trade, the President of the Board of Education, the Chief Secretary for Ireland, and any others whom it may be thought desirable to add. The first non-official members of the Council will be Lord Haldane, Mr. A. D. Acland, and Mr. J. A. Pease, M.P. The first members of the Advisory Council will be Lord Rayleigh, F.R.S., Dr. G. T. Beilby, F.R.S., Mr. W. Duddell, F.R.S., Prof. B. Hopkinson, F.R.S., Prof. J. A. McClelland, F.R.S., Prof. R. Meldola, F.R.S., Mr. R. Threlfall, F.R.S., and Sir William McCormick, who will be Administrative Chairman.

GERMANY'S "MOBILISATION" OF COPPER

WE have before us an authoritative article recently published in Germany on the present position of that country as regards copper supply. It is a broad review of the situation, by a writer evidently possessing a good technical knowledge and more or less accurate information on the subject upon which he writes, and no attempt is made to minimise the great inconvenience which has already been caused by the German Government having taken possession of all stocks of raw and partly-manufactured copper for the Army. It is also admitted that the public must be prepared for more drastic measures in this respect; but one thing stands out clearly and must be noted for the benefit of optimists who persist in construing every move taken by Germany as a sign of an almost immediate collapse. *There is copper in Germany sufficient for Army requirements for years and not merely for months; it is true that the "mobilisation" of the metal will continue to cause the civil population some inconvenience, but it is equally apparent that, unless the war lasts many years, shortage of copper will not, as has been predicted in some quarters, be a determining influence in bringing the war to a conclusion.*

The article, which was published in the "Elektrotechnische Zeitschrift" of July 29th under the title "The Mobilisation of Copper," after referring to the requisition by the Army, as already mentioned, of all raw and partly-manufactured copper available, estimates the stock of manufactured copper "in the hands of the public" at two million tons. The term "in the hands of the public" is perhaps not quite a happy one for strict accuracy, for a considerable proportion of this stock is in the form of copper roofing on public buildings, etc., which is a feature of German architecture. How soon this stock will be drawn upon is not stated, but the German War Office has already instituted an Office for Metal Mobilisation, which on July 20th issued an order for a register to be made of the copper held by certain sections of the public (including electricity and other works) as represented by a large range of manufactured articles, both new and old, consisting wholly or partly of unalloyed copper, including tinned copper, and copper covered with a coating of other metal or paint. A form has been issued to enable the register to be made, and its return is compulsory; there is a column in it in which voluntary offers of copper for sale may be filled in, and the article in our contemporary makes an appeal to copper users to do all they can in this direction, so as to ward off a general calling-up of manufactured copper articles.

The writer of the article suggests, in the first place, the replacement of all overhead copper wires by zinc or iron wires, but admits that a difficulty will arise in many cases owing to the fact that the existing poles, insulators, etc., may not be strong enough to carry the requisite heavier weight of these substitutes. To overcome this he proposes that larger voltage drop in the lines should be allowed, and this would enable the copper lines to be replaced with others of smaller section even if the substitution of them by iron wires is not found feasible. This leads him to the suggestion that higher transmission voltages should be resorted to wherever possible, as the copper required for the transformers would be inconsiderable compared with that saved on the line, and he goes further and advises that, to make a virtue of necessity, numbers of the older electric light and power systems should be modernised. Towns still supplied on the low tension direct current system with long feeders of large section might with advantage, he says, have their systems converted to three-phase high pressure transmission with rotary sub-stations at the feeding points, but he does not insist upon these drastic measures being taken immediately. In Germany, as in this country, there are large numbers of reciprocating sets standing comparatively idle as "reserve plant" in electricity works in which the load is regularly taken by modern turbine machines. The amount of copper in these per kw. output is of course far greater than in the turbo-generators, and he invites serious consideration of the "slaughter" of these innocents in the service of the Fatherland. Finally, the writer even goes so far as to suggest the reconstruction of many of the older transformers, to utilise the newer iron alloys for their cores, and so to diminish the proportionate weight of copper.

Obviously some of these measures are extreme ones—some, indeed, hardly merit serious thought. It must not be inferred, however, that this implies an immediate copper famine, any more than the issue of bread tickets in Germany months ago presaged an immediate bread famine. There has been sufficient evidence during the past year of the useful German habit of looking forward and methodically providing for any emergency, and the moral to be drawn from such articles as the one now reviewed is that, although Germany is provided for a long time to come with sufficient copper

for war requirements, yet she is prepared to adopt heroic measures for providing further supplies should emergency arise. The author of the article, in fact, uses the argument that, although it may be long before the more easily acquired stocks of copper will be exhausted, yet the modifications in existing conditions which he outlines will also take long to carry out, and that therefore it is not too early to give consideration to them.

MAGNETISATION OF IRON BY AN ALTERNATING FIELD

A CONTRIBUTION to the *Journal of the Institution of Electrical Engineers* describes an investigation by Mr. H. W. McLachlan into the behaviour of iron under magnetisation of sinusoidal wave-form. First of all, the effect of bending the samples to form test rings was investigated by comparing a bent-up ring with one composed of stamping, and it was found that the bending of thin plates of "Lohys," resulting in permanent set, does not affect the magnetic properties to any appreciable extent when the magnetisation is produced by a steady current. The permeability is lower at small flux densities, this being due to the joints in the strips whereby slight air-gaps are introduced. The permeability is affected in the same way when the magnetisation is produced by an alternating current of sinusoidal wave-form. In this case there is an increase in the hysteresis due to mechanical stress.

The main experiments lead to the following results:—When the magnetisation is produced by an alternating current of sinusoidal wave-form the permeability is greater than with static fields. This phenomenon was observed from maximum flux densities from 700 to 16,000 lines per sq. cm. For all values of the flux density in the iron up to 16,000 lines per sq. cm. the form factor and the ratio of the maximum and R.M.S. voltages are greater than the corresponding quantities when the voltage wave-form is sinusoidal, by an amount depending on and increasing with the maximum flux density. The R.M.S. and maximum values of the voltage are larger than those obtained when the voltage wave is sinusoidal by an amount depending on and increasing with the maximum flux density. For frequencies up to 500 periods per second the R.M.S. voltage is higher than that when the voltage wave is sinusoidal, but the lowering of the maximum flux density due to eddy currents is very prominent. When the magnetisation is produced by a current the wave-form of which is approximately sinusoidal, the above conclusions are applicable. The difference between these results and those obtained when the voltage wave is sinusoidal is not so marked as the difference between the latter results and those obtained when the current is sinusoidal. Whether the current be sinusoidal or approximately sinusoidal, the R.M.S. voltage across the secondary coil is proportionately higher at 25 periods per second than at 50 periods per second for a given magnetising current.

THE BRITISH ASSOCIATION

THE programme of the meeting of the British Association which is to be held at Manchester from Sept. 7th to 11th, under the Presidency of Prof. Arthur Schuster, has been issued. As already announced, the meeting this year will be devoted exclusively to the technical work, the whole of the usual social programme having been eliminated.

The sectional meetings have been arranged as usual, Section G (Engineering) having for its President, Dr. H. S. Hele Shaw, F.R.S. The following are the electrical papers to be read in this section: "The Heating of Iron when Magnetised at Very High Frequencies," by N. W. McLachlan; "Some Experiments to Determine whether there Exists Mutual Induction between Masses," by Prof. Miles Walker; "The Eddy Current Losses in the End Plates of Large Turbo-Generators," by Prof. Miles Walker; "Electric Oscillations in Coupled Circuits—a Class of Particular Cases," by Dr. W. H. Eccles and Mr. A. J. Makower; "The Capacity of Aerials of the Umbrella Type," by Prof. G. W. O. Howe; "The Calculation of the Effect of Masts and Buildings on the Capacity of Aerials," by Prof. G. W. O. Howe.

A number of matters in other sections may also be mentioned. In Section B (Chemistry) there will be a discussion on "Smoke Prevention," and in Section L (Educational Science) a discussion will take place on "Education and Industry." A report of the Committee on Industrial Fatigue, to be presented to Section F (Economic Science and Statistics), may also produce some points of interest, whilst a discussion in the same section on the production of industrial harmony will attract attention having regard to recent happenings in the labour world.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,455.

Is it usual to make the air-gap length of large D.C. and A.C. motors and generators equidistant under all poles of a given machine, or is the gap less under the top poles? If the latter is the case, why is it done? How much is this reduction for various sizes and types of machine, and what calculation is this reduction based upon? What method is employed to set the machine out of centre?

(Replies must be received not later than first post, Thursday, August 19th.)

ANSWERS TO No. 1,453.

Is it practicable, and are there any circumstances in which it is advantageous, to take the excitation circuit of a 4-pole dynamo from one pair of brush arms while the other pair is used only for the load?

The first award (10s.) is given to "H." for the following reply:—

For a standard type of dynamo there is no advantage in making the connections as suggested in the question; in fact, in some cases the arrangement is impracticable. It must be remembered that armatures are almost invariably either wave (series) or lap (parallel) wound. In a wave-wound armature of a multipolar dynamo there are only two circuits; in other words, the current per conductor is half the total current from the machine. The current from such a winding can therefore be collected by a pair of brush-arms, but in order to shorten the length of the commutator (the brush width and current density being maintained constant), another pair of brush-arms is provided. The positive and negative brushes of the second pair are really connected to the corresponding brushes of the first pair by armature conductors which in that particular position have no E.M.F.'s induced in them. It should now be clear that the arrangement referred to in the question would require the commutator to be almost doubled in length, while the excitation circuit would really be connected across the same voltage as the load. The effect would be to increase the cost of the machine without any advantage being derived.

In a 4-pole lap-wound armature fitted with four sets of brushes there are four circuits in parallel. Consequently, if the load is taken off only one pair of brushes, the current in the armature conductors is unsymmetrical; in fact, a fourth of the conductors will be carrying three times the current in the other conductors. This distribution of the currents results in the magnetic forces between the armature and the various poles being unequal; also the output (as determined by the heating of the armature) is limited to about a third of its normal value, whilst the voltage for excitation is practically the same as that across the load. The arrangement in question would consequently be impracticable in the case of a lap-wound armature.

For some applications, such as train lighting, all sorts of

arrangements have been tried from time to time, but a consideration of these would be out of place here. Suffice it to say that in such cases either the armature is specially wound or auxiliary brushes are employed with or without split-poles.

The second award (5s.) is made to "N. C. W." who writes as follows:—

The solution to this question involves a consideration of the type of armature windings. These may be broadly classified as "wave" and "lap." In the wave winding there are only two paths through the armature, and only two sets of brushes are essential, though it is customary in dynamos of any large size to supply one set of brushes per pole. In a 4-pole wave-wound machine with four sets of brushes, the two positive brushes are connected through the commutator by inductors generating no E.M.F. Provided that one set of brushes is of sufficient section for carrying the load current, one pair may be reserved for feeding the excitation circuit. The disposition of the leads to the mains and field magnet coils may make this arrangement advantageous by saving a certain amount of cross-connecting wire; on the other hand, it will be impracticable to raise any one set of brushes for cleaning or adjusting purposes while running, as may be readily done when the two pairs are externally cross-connected in the usual manner. A slightly higher E.M.F. may, however, be secured, since the drop of potential in the independent magnet connections to the commutator will be less than when the same brushes carry the main current.

Lap windings are generally employed for lower pressures and larger currents; they have as many paths through the armature as there are poles, and these being all in parallel the total current should be evenly distributed between them. For this purpose all brushes of the same polarity should be heavily cross-connected, it being most important that these be maintained at the same potential, otherwise an irregular distribution of load current in the armature will result, promoting sparking and attendant difficulties. For a lap winding, therefore, the proposal cannot be recommended.

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

THE next session of the Engineering Department of the University of Edinburgh will open on October 12th, and the entrance examination for new students will be held in September. The complete three years' course in electrical engineering qualifies for the degree of B.Sc. Particulars can be obtained from the matriculation office.

The date of the entrance examination of the City and Guilds (Engineering) College, South Kensington, has been altered from September 21st to September 22nd.

The South-Western Polytechnic (Manresa Road, Chelsea) will reopen on Sept. 27th for day and evening classes. The Engineering Courses include lectures in Electrical and Mechanical Engineering, Physics, Chemistry and Mathematics, and practical instruction in the laboratories. Students are prepared by recognised teachers of the University of London for the B.Sc. Degree in Engineering, for the examinations at the Engineering Societies, and of the City and Guilds of London Institute. The evening courses also include classes in electrical wiring and other trade subjects. In the Electric Wiring Department an advanced course has been arranged for the preparation of candidates for the Final Wiremen's Examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. The Prospectus may be obtained on application to the Secretary, Electrical Engineering Training.

Generating Station Damaged by Fire.—On Sunday of last week a serious fire occurred in the power station of the Ebbw Vale Steel, Iron, and Coal Co., at Victoria, South Wales, and despite the effort of the local fire brigades, the generating plant, much of which is practically new, was badly damaged. We understand, however, that the newspaper reports were considerably exaggerated, and that the damage done was principally to accessories. Owing to the cessation of the power supply, a large proportion of the steel mills and other works were stopped, and a colliery was rendered idle, throwing some thousands of men out of work. The whole of the works and collieries had fully resumed work on Monday. The station also supplied lighting to the town, which was put in darkness.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Electric Light Fitting. By S. C. Batstone. 317 pp. 7½ in. by 5 in. 238 figures. (London: Whittaker & Co.) 5s. net; abroad, 5s. 5d.

On turning over the leaves of this book one receives a first impression of completeness and practical value. Examples of the lay-out of actual installations are given with plans of buildings, several good drawings of accessories are included, and there is a chapter on private plants which actually goes into such detail as the calculation of loss of head in a water-power plant, due to pipe friction. On examining the matter more closely, however, it becomes apparent that its value is greatly impaired by almost unparable carelessness. Thus, although Ohm's law is explained with the help of a pump and pipe analogy, we cannot find any definite instructions how to apply this law to the practical calculations of voltage drop in a cable; in the reference to alternating currents, the reader is told that the impedance of a circuit is equal to inductance plus ohmic resistance, and that the square of the impressed volts is equal to the sum of the squares of the inductance and the ohmic resistance; the description of the calculation of loss of head in pipes, already referred to, is almost unintelligible; and the illustration of a steel-wire armoured cable shows a braided cable surrounded by a single galvanised iron wire wound round it in an open helix like an armoured hose-pipe.

The drawings are for the most part excellently done, but some of them represent an unnecessary waste of space. It would seem to be unnecessary to explain what is meant by a "polished teak main switchcase with glass front, lock and key" by means of a drawing; the only value in this might be to indicate the clearance which it is advisable to leave between the switch and the case, but the switch itself is not shown, although the fact that the key has been forgotten shows that the author is alive to practical conditions. Other drawings show ordinary switches and lampholders in great detail, and even candle-shades; an illustration of the familiar well-glass fitting is carefully lettered to show which is the tube and which the well-glass, but the practical tip of using rubber rings on both sides of the lip of the well-glass is not considered worthy of mention; and there is a picture of the dear old scarfed joint in a stranded conductor, which has, we are sure, never been made by any wireman in the present century. In one of the conductor tables, the "safe" currents are calculated on the basis of 1,000 amperes per square inch, and in another the I.E.E. ratings are given; it is a matter of almost daily occurrence to decide whether a 5-ampere radiator may be connected on a 3/22 circuit, and the reader is left in the quandary that one end of the book says that 1·8 amperes is the safe current, and the other end of the book gives it as 7·2 amperes.

Notwithstanding the defects in the book, it is obvious that the author possesses knowledge and experience in his subject, and from the drawings it is clear that he is a man who can take pains. Should a second edition ever become necessary, we hope that he will do himself better justice.

Electric Bells, Alarms, and Signalling Systems. By H. G. White. 84 pp. 7 in. by 4½ in. 57 figures. (London: S. Rentell & Co., Ltd.) 1s. 6d. net; by post, 1s. 8d.

The collection of diagrams should save the bell installer considerable time, but the author has not made the most of his opportunity. Valuable assistance might have been given in the way of more specific guidance as to the number and size of cells to be selected for installations of various character and extent, and far more than the adoption of a correct diagram of connections is necessary in designing the more complicated hotel installations. The author, moreover, is not correct in his assumption that single stroke bells are employed for little else than railway and mining work; within almost a stone's-throw of his publishers' offices there has been for several years an installation of these in use, the proper maintenance of which may literally be a question of life or death. It is true that the employment of single-stroke bells for signalling purposes in public institutions has not been developed to the extent it deserves, but in some quarters considerable attention has had to be devoted to the efficient arrangement of such installations. One of the questions that constantly arises in the very simplest of bell installations has been neglected by the author, although a chapter is devoted to maintenance work: Not one bell-fitter in ten knows the weight of sal-ammoniac, which should be used in a Leclanché cell of each of the three sizes. It is not improbable

that tons of this material are lying wasted at the bottom of cells all over the country, serving no purpose but to augment the trouble due to "creeping" and to hasten the corrosion of the zincs and connections. A book with the title of the present volume should also discuss the relative merits of wet and dry cells and the applicability of each. Finally, mention may be made of a chapter on mine signalling, which includes descriptions of various systems on the market.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Wiring of Finished Buildings." By T. Croft. 275 pp. 8½ in. by 5½ in. 205 figures. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 8s. 4d. net.

"Advanced Theory of Electricity and Magnetism." By W. S. Franklin and B. MacNutt. 300 pp. 8½ in. by 5½ in. About 260 figures. (New York: Macmillan Co.; London: Macmillan & Co., Ltd.) 8s. 6d. net; abroad, 9s. 1d.

"Labour Unrest: War-time Thoughts on a National Danger." By G. E. Toogood. 78 pp. 7½ in. by 4½ in. (London: A. Brown & Sons, Ltd.) 6d. net; by post, 7½d.

"Continuous-current Electrical Engineering." By W. T. Maccall. 466 pp. 8½ in. by 5½ in. 385 figures. (London: W. B. Clive.) 10s. 6d.; abroad, 11s.

"Single-phase Electric Railways." By E. Austin. 803 pp. 11½ in. by 7½ in. 346 figures. (London: Constable & Co., Ltd.) 21st. net; British Colonies, 22s. 4d.; other countries, 21s. carriage forward.

"Electric Railway Handbook." By A. S. Richey, assisted by W. C. Greenough. 832 pp. 6½ in. by 4½ in. 654 figures. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 17s. net.

"Electricity for the Farm." By F. J. Anderson. 265 pp. 7½ in. by 5 in. 49 figures. (New York: The Macmillan Co.; London: Macmillan & Co., Ltd.) 5s. 6d. net; abroad, 6s.

"Constant-voltage Transmission." By H. B. Dwight. 115 pp. 7½ in. by 5 in. 14 figures. (New York: John Wiley & Sons; London: Chapman & Hall, Ltd.) 5s. 6d. net; abroad, 5s. 9d.

"A.B.C. of Electricity." By W. H. Meadowcroft. 127 pp. 6½ in. by 4½ in. 88 figures. (London: Harper & Bros.) New edition. 2s. net; by post, 2s. 3d.

"A Treatise on Hand Lettering for Engineers, Architects, Surveyors, and Students of Mechanical Drawing." By W. J. Lineham. 282 pp. 12½ in. by 8½ in. 117 plates. (London: Chapman & Hall, Ltd.) 7s. 6d. net; abroad, 8s. 8d.

"Dielectric Phenomena in High-voltage Engineering." By F. W. Peek, jun. 265 pp. 9½ in. by 6½ in. 190 figures. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 12s. 6d. net.

"Arithmetic of Alternating Currents." By E. H. Crapper. 208 pp. 7½ in. by 5 in. 45 figures. (London: Whittaker and Co.) 2s. 6d. net; by post, 2s. 8d.

"Alternating-current Work." By W. P. Maycock. 415 pp. 7½ in. by 5 in. 258 figures. (London: Whittaker & Co.) 6s. net; abroad, 6s. 6d.

"Alignment Charts: Their Principle and Application to Engineering Formulae." By E. S. Andrews. 32 pp. 7½ in. by 4½ in. 11 figures. (London: Chapman & Hall, Ltd.) 1s. 3d. net; by post, 1s. 4d.

"The Slide Rule." By C. N. Pickworth. 122 pp. 7½ in. by 5 in. 37 figures. (Manchester: Emmott & Co., Ltd.) 18th edition. 2s. net; by post 2s. 8d.

"The Motor Manual." 266 pp. 7½ in. by 5½ in. 298 figures. (London: Temple Press, Ltd.) 18th edition. 1s. 6d. net; by post 1s. 9d.

"Modern Boiler-room Practice and Smoke Abatement." By J. T. Hodgson. 321 pp. 8½ in. by 5½ in. 209 figures. (London: The Railway Engineer.) 3s. 6d. net; abroad, 4s.

"The Light Car Manual." 208 pp. 7½ in. by 5½ in. 161 figures. (London: Temple Press, Ltd.) Second edition. Paper covers, 1s. net; by post, 1s. 3d. Cloth, 1s. 6d. net; by post, 1s. 9d.

"Halifax: A Commercial and Industrial Centre, 1915." Edited by G. P. Wadsworth. 127 pp. 9½ in. by 7½ in. 34 figures. (London: Sells, Ltd.) 2s. 6d. net; by post, 2s. 10d.

"Handbook of Patent Law of all Countries." By W. P. Thompson. 242 pp. 6½ in. by 4½ in. (London: Stevens & Sons, Ltd.) 16th edition. 2s. 6d. net; by post 2s. 9d.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published August 5th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

27,059 and 27,060/13. Dust Precipitation. G. A. KRAUSE. The first of these describes a method of separating dust particles from gases or air by passage of the gas to be treated through a chamber equipped with two sets of "collecting" electrodes of like polarity, while the "charging" electrodes (of opposite polarity to the collecting electrodes) are in a separate chamber through which the gas passes first. (Two figures.) The second specification deals with the use of rectified A.C. of very high potential, with a multiple spark-gap in the circuit for dust precipitation. (One figure.)

27,157/13. Metal Filament Lamps. G. LÜDECKE and BRIMSDOWN LAMP WORKS, LTD. Supports for filaments made of wires or other structures of an alloy of nickel with 50 per cent. of tungsten.

29,946/13. Wireless Telegraphy. VON ARCO and MEISSNER. A system of wireless telegraph transmission in which the oscillations are produced without dischargers, &c., by an alternator of moderately high frequency in conjunction with a special arrangement of frequency raising, partly separately excited, transistors, and resistances. The system is described in considerable detail in the specification, and there are no less than 29 claims. (25 figures.)

963/14. Electric Locomotives. K. VON KANDO. A method of driving in which the motors are connected through gearing with an intermediate shaft provided with cranks connected by coupling rods with the driving wheels. The motors are mounted on the frame through resilient supports. (Two figures.)

1,056/14. Incandescent Lamps. B.T.-H. Co. (A.E.G.). A leading wire composed of materials having different coefficients of expansion made so that the relative proportions of the two materials vary within a short range, so that at one point at least the compound wire has the same coefficient of expansion as glass. (Two figures.)

16,111/14. Safety Appliance. J. G. CONWAY. A man working near high-tension conductors is protected from liability to shock by gloves covered with wire gauze and connected through a harness of conducting straps to metal heel plates in the boots. (Four figures.)

17,331/14. High-frequency Alternator. A. HEYLAND. A high-frequency alternator with a salient pole field system and an armature, the iron surface of which forms segments which necessarily bridge the pole-tips of opposite polarity under different phases. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MEIROWSKY & CO. and MEIROWSKY [Insulating materials] 11,112/14; LONGBOTTOM and FARRAR [Conduit joints] 17,437/14; BRIT. INS. & HELSBY CABLES, LTD., and BROTHERTON [Cables] 4,761/15.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. CO. and HASTINGS [Motor control] 17,894/14; LEIGH and OSBORN [Means of obtaining high starting torque] 121/15.

Electrometallurgy and Electrochemistry: DEUTSCHE GOLD & SILBER-SCHELDE-ANSTALT VORM. RÖSSLER [Electrolytic production of alkali metals] 10,193/14; BATTLE [Electrolytic metal cleaning and recovery of tin] 14,513 and 14,514/14; OZIL [Electro-deposition] 16,776/14; EVANS (Elektrochemische Werke Ges.) [Furnace electrodes] 17,425/14 and [Method of producing a flow in molten masses and a furnace] 17,426/14.

Heating and Cooking: COLLINS & COLLINS [Heating apparatus] 17,391/14.

Ignition: BELLAMY [H.T. ignition] 15,758/14; T. CROSBY &

SONS and McGREGOR [Sparkling plugs] 19,886/14; VAN RADEN [Sparkling plugs] 3,715/15.

Incandescent Lamps: GILL (Wolfram Lampen A.G.) [Incandescent lamps] 29,981/13; HUGHES [Filaments] 17,332/13.

Instruments and Meters: H. ARON ELEKTRICITATSZAHLERFABRIK GES. [Prepayment meters] 10,417/14; SIEMENS & HALSKE A.G. [Time recorders] 10,477/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Measuring instruments] 17,317/14; EVANS (A.E.G.) [Protection of meters] 17,424/14.

Storage Batteries: R. BOSCH [Battery terminals] 10,478/14.

Switchgear, Fuses and Fittings: WATERS [Protective systems] 23,449/13; IGRANIO ELECTRIC CO. (Cutler-Hammer Mfg. Co.) [Contacts] 20,133/14.

Telephony and Telegraphy: DR. ERICH F. HUTH GES. [Spark gaps] 28,369/13; SIEMENS BROS. & CO. (Siemens & Halske A.G.) [Automatic telephones] 29,833/13; SIEMENS BROS. & CO. and BAKER [Telephones] 11,052/14; VON LEPPE [Production of oscillations] 11,102/14; SIEMENS BROS. & CO. (Siemens & Halske A.G.) [Telephone circuits] 11,212/14; INTERNATIONAL ELECTRIC CO. (A.G. Mix & Genest) [Telephones] 14,798/14; FORRESTER (International Callophone Corporation) [Loud-speaking telephones] 21,921/14 and 8,561/15; SIEMENS-SCHUCKERTWERKE GES. [Stray wave protective devices for wireless telegraphy] 831/15; WESTERN ELECTRIC CO. (W.E. CO., U.S.A.) [Wave amplifier] 275/15.

Traction: FRANK [Track circuit apparatus] 29,665/13; WIRTH [Train control] 29,689/13; SIEMENS-SCHUCKERTWERKE GES. [Means of pulling off overhead conductors] 30,045/13; BRAIN and HODGSON [Signalling] 16,696/14; BELFIELD (Doyle & Hedley) [Couplings] 20,871/14.

Miscellaneous: KRAUSHAAR [Electric miners' lamp] 134/14; ROSSOW [Protection of miners' lamps] 10,674/14; ÖSTERREICHISCHE SIEMENS-SCHUCKERTWERKE & REGAL PATENTE GES. [Electrical Jacquard apparatus] 11,408 and 11,410/14; OTTO [Rectifier] 11,561/14; BIGGIN ["Galvanic" boots] 16,962/14; KAHLAN (Yapolsky) [Light sensitive apparatus] 17,131/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, &c.: BRITISH WESTINGHOUSE ELECT. & MFG. CO. [Supply to D.C. motors] 10,131/15.

Switchgear: BRITISH WESTINGHOUSE ELECT. & MFG. CO. [Circuit breakers] 10,130/15.

Telephony: AKTIESELSKABET ELEKTRISK BUREAU [Automatic telephones] 10,050/15.

Traction: KETTERING [Engine starters] 7,758/15; ÖSTERREICHISCHE DAIMLER MOTOREN A.G. [Electrical change speed gear] 9,682/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, AND TRANSFORMERS: D. BALACHOWSKY [Dynamo and motor control] 9,157/07.

Electrochemistry and Electrometallurgy: A. J. PETERSSON [Furnaces] 9,164/06; A. E. EDWARDS (Hille & Müller) [Electroplating] 9,435/06; J. R. WILLIAMS, H. W. BRADLEY, and B. BRADLEY [Electrocatalysis] 9,796/09.

Switchgear, Fuses, and Fittings: H. L. DIXON [Fuses] 8,883/03.

Telephony and Telegraphy: F. RITCHIE [Telautographs] 9,009/07; T. MCKENNA (General Acoustic Co.) [Telephone systems] 9,350/09.

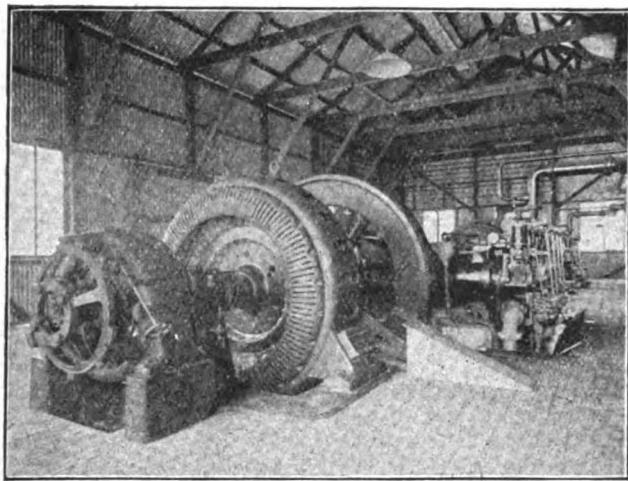
Traction: C. DE KANDO [Overhead conductors] 9,341/06.

Miscellaneous: I. H. PARSONS [Bells, indicators, &c.] 9,324/03.

London Wiremen's Wages.—Although on the outbreak of war the dispute between the London wiring contractors and their men was ended by the men accepting the masters' offer of 10½d. per hour, there has since been negotiations with respect to a request for a further increase, owing to the increased cost of living due to the war. The matter, we understand, finally went to arbitration, and it is believed, although the award has not yet been issued, that the men have been granted a further 1½d. per hour, making the London rate 1s. per hour.

ELECTRICAL DRIVING IN CEMENT WORKS

THE extensive application of electricity for driving cement works machinery applies to the Overseas Dominions just as much as to this country. A recent installation of electrical plant for this purpose is that of the Adelaide Cement Co., of Adelaide, N.S.W. Gas engines were selected for the prime movers, the installation consisting of two 380-h.p. four-cylinder horizontal gas engines, running at 214 r.p.m., and manufactured by the Premier Gas Engine Co. (Sandiacre, near Nottingham), coupled to 275-k.v.a. "Witton" alternators supplied by the British General Electric Co., Ltd., of Sydney, and constructed at Witton, Birmingham, England. The gas producers were manufactured in South Australia by Messrs. Clutterbuck Bros. from designs prepared by their consulting engineer, Mr. W. S. Saunders. Power is supplied to the works motors at 440 volts, 50 cycles, and the generators are designed for a power factor of 0·725. There are several interesting features about this installation. In the first



POWER HOUSE OF THE ADELAIDE CEMENT CO., CONTAINING TWO 275 KV.A. "PREMIER" GAS ENGINES DRIVING "WITTON" ALTERNATORS.

place, good parallel running has been successfully obtained, and the two units run in parallel without the slightest trouble. This is said to be the only plant in Australia in which three-phase gas-driven alternators are run in parallel. Not only do the sets run satisfactorily in parallel at no load as well as full load, but they run well when one of the cylinders is cut out. A second point of interest is the low fuel consumption. On the official tests the weight of fuel consumed per kw.-hour was 1,221 lb., the fuel used being gas-coke. This performance was nearly 25 per cent. better than the guarantee. With regard to governing, during the official tests full load was thrown off the engines and then switched on again; in both cases the engines showed no appreciable variation of speed. The electrical side of the contract was arranged and the plant installed under the supervision of Messrs. Colton, Palmer & Preston, who are the Adelaide agents of the British General Electric Co., Ltd.

Triple Frequency Harmonics.—An interesting example of the effect of triple frequency currents in a mesh-connected alternator is recorded in the *Electrical World*. It appears that the windings of a 750 kw. alternator in a generating plant at Indianapolis were changed from star to mesh, when it was found that the machine ran best even on open circuit. Further investigation disclosed the fact that when the machine was developing full normal voltage on open circuit there was being circulated in the delta-connected windings a current equal to 125 per cent. of full-load current. The delta circuit was opened, and an ammeter and a fixed inductance were inserted into a voltmeter around the inductance. After taking simultaneous readings of the current through the inductance and the voltage drop around it, the engineers making the test placed the same inductance and the same instruments in a sixty-cycle circuit, passing the same value of current through the inductance that had flowed through it when it was connected in the delta winding. Reading the voltage drop around the inductance as it carried this current value in the sixty-cycle circuit, the investigators found the drop to be just one-third that which had been registered with the inductance in series with the delta. From this it was deduced that the frequency of the harmonics in the delta must have been three times the frequency of the sixty-cycle circuit.

CATALOGUES, PAMPHLETS, &c., RECEIVED

POSTER STAMPS.—A very effective series of coloured "poster stamps," calling attention to street pillars, terminal boxes, joint-box compounds, colliery boxes, service cut-outs, &c., has been issued by W. T. Henley's Telegraph Works Co., Ltd. (Blomfield Street, London Wall, E.C.), and form an attractive way of advertising these articles.

CANDLE LAMPS.—The Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex, and 123-125 Queen Victoria Street, E.C.) have issued a revised pamphlet describing their well-known "Kinglite" electric candle. This has a special shaded lamp illuminating the upper part of the opal tube with a charming effect, and has the great advantage over some other candle fittings that a locking ring screwed tightly down on the socket keeps the candle firmly fixed in a vertical position.

CIRCUIT-BREAKERS.—Another new list from the Edison & Swan Co. deals with circuit-breakers for continuous current of the free handle type with main and auxiliary contacts and magnetic blow-out, which can be provided with time-limit feature and overload, reverse current or no-voltage, or combined overload and reverse current release. These are made in a large range of sizes in both the open and enclosed patterns.

STAR-DELTA STARTERS.—A series of standard sizes of air-break star-delta starters for squirrel-cage induction motors up to 25 h.p. are described in a new price list from the British Thomson-Houston Co., Ltd. (Rugby). These are provided with an automatic stop which ensures the lever being held in the starting position sufficiently long for the motor to come up to speed, and can be fitted with no-voltage release and overload protection.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRO-GALVANISING.—A leaflet from S. Cowper-Coles (1 and 2 Old Pye Street, Westminster, S.W.) describes the Cowper-Coles electro-galvanising process, in which a particularly even coating of zinc can be electrolytically deposited on any kind of iron and steel work.

LEAD COATING.—The Homogeneous Lead Coating Co. (Sunbury-on-Thames) have sent us a leaflet calling attention to their process of applying a welded lead protective coating to iron and steel surfaces.

METAL FILAMENT LAMPS.—We have received from the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), a copy of their latest revised list of Mazda wire-drawn lamps of standard sizes up to 400 watts for ordinary voltages, and including candle, tubular, sign, and traction lamps. All these lamps are made in the company's works at Rugby.

RESISTANCE NETS.—A card from the Cressall Manufacturing Co. (40 and 41 Staniforth Street, Birmingham) calls attention to various forms of woven asbestos and wire resistance nets for heating, motor control, and other purposes, manufactured by the company at Birmingham. A small sample showing the nature of these nets is attached to the card.

WEIGHT AND CURRENCY COMPUTER.—A leaflet from F. Seaton-Snowdon (22 Henrietta Street, Covent Garden, W.C.) gives particulars of an ingenious instrument, resembling a date indicator with a strip wound up by rollers, for converting foreign weights, measures, and moneys. The headings of British, French, Russian, Scandinavian, Japanese, and American prices per unit weight and measure are set out on the left, and the values that appear on the strip through the window at the same time are all equivalent.

A.C. MOTORS.—A revised price list of single-phase, two-phase, and three-phase induction motors of the slip-ring and squirrel-cage types has been issued by the Langdon-Davies Motor Co. (110 Cannon Street, E.C.). A considerable range of sizes, voltages, speeds, and frequencies are listed, and prices of starters and other accessories are included.

Effect of the War on Electricity Supply in Switzerland.—Owing to the large number of men in mobilisation, many manufacturing works are uncertain as to their output, and strong pressure has been brought to bear upon the electric power supply companies to waive the clauses in agreements relating to the minimum amount of electrical energy to be consumed. In Lucerne, an interesting step has been taken in view of the shortage of lamp oil. To facilitate the replacement of oil lamps by electric light, the municipality (which owns the electricity works) is putting in services free up to a value of £6, and is accepting payment for the installation in monthly or quarterly instalments spread over four years.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Bootle.—Extensions of plant are contemplated to meet the increasing demand and also to replace the Pine Grove Works.

Chesterfield.—A scheme of extensions, estimated to cost £15,200, has been drawn up. It includes a 2,000 kw. turbo-alternator, switchboard, cables, crane, superheaters, and mechanical stokers for existing boilers.

Earby.—Dynamo, battery, wiring, etc., at Sewage Disposal Works. Engineer, Council Offices. Aug. 16th.

Exeter. Repairs and renewals to battery, Devonshire County Asylum. Architects, E. H. Harbottle & Sons, County Chambers. (See an advertisement on another page.)

Hastings.—A main estimated to cost £80 is to be laid.

Leyton.—A Local Government Board inquiry was held last week concerning a loan of £18,158 for electrical extensions. The Inspector gave the usual intimation that a loan could not be authorised except to deal with firms working on Government contracts. There are a number of such consumers, but the Council expressed its anxiety to obtain sanction to the full loan in order to be quite ready to instal new plant immediately the war is over.

Lytham.—Application is to be made for the necessary loan for carrying out the scheme of obtaining a bulk supply for St. Anne's. The draft agreement has been drawn up.

Nelson.—Electric motors are to be installed at the sewage works.

St. Helens.—An expenditure of £15,000 is contemplated upon electricity extensions.

South Africa.—The Johannesburg Council requires two 3,000 kw. turbo-alternators. Town Clerk. Sept. 25th. Specifications may be seen at 73 Basinghall Street, E.C.

Wednesbury.—Additional plant for the King's Hill sub-station is required at a cost of £1,580; the necessary connecting cables are estimated to cost £420. Loans of these amounts in addition to £815 for further cable extensions are to be applied for.

Wiring

Bristol.—Wiring of sheds at docks. Engineer, Cumberland Place. Aug. 20th.

Hull.—Two houses, City Asylum. City Architect, Aug. 17th.

London: L.C.C.—Winchester Street Elementary School, Pentonville Road, N.; 93 lighting points. Chief Engineer. Aug. 23rd. (See an advertisement on another page.)

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Blackburn.—Additions to infirmary.

Edinburgh.—Additions to Inland Revenue Offices. H.M. Office of Works, London.

London.—New headquarters, Euston Road, Ancient Order of Foresters.

Manchester.—Warehouse, Turner Street. Architect, C. Swain.—Workshop, Buckley Street. Architect, Adshead & Topham.—Workshop, Openshaw. Architect, J. H. Lang.

Miscellaneous

H.M. Office of Works.—Enamelled conduit and fittings. Aug. 20th. (See an advertisement on another page.)

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Eastbourne.—The tender of the Stanton Ironworks Co. has been accepted of circulating water piping and valves.

Hull.—A tender of Messrs. Dick, Kerr & Co. for a turbo-alternator at £13,315 has been accepted.

APPOINTMENTS AND PERSONAL NOTES

In a note under this heading on p. 334 of our issue last week we referred wrongly to Mr. R. N. Mayne as the Borough Electrical Engineer at Nuneaton. Mr. Mayne, of course, is at Redditch.

The Sutton Coldfield Corporation requires an Electrical Engineer. Commencing salary £250 per annum. Applications to Town Clerk, Sept. 1st.

Messrs. John Walsh, Ltd., of Sheffield, require a man to buy for and manage their electric wiring and fittings department.

Three shift engineers are required in the Birmingham Corporation Electricity Department. (See an advertisement on another page.)

The North Metropolitan Electric Power Supply Co. want junior assistant engineers for switchboard work. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £83 to £84 (last week, £86 10s. to £87 10s.).

Agencies.—A Montreal engineer wishes to represent British makers of power plant apparatus and equipment. Board of Trade, 73 Basinghall Street, E.C.

A Melbourne firm desires the agency of a British firm manufacturing direct-current and three-phase motors, lamps, and electrical goods generally. Agent-General for Victoria, Melbourne Place, Strand, W.C.

Advance in Prices.—The General Electric Co., Ltd., announce an advance of 25 per cent. in their list prices of switchgear and switchboards.

LOCAL NOTES

Barking: L.G.B. and Extensions.—An application was made recently for a loan of £18,000 for new plant to meet the increasing demands upon the electricity undertaking. The Local Government Board has suggested that the amount in question should be reduced as much as possible and a revised estimate has been sent to the Board. Tenders have been provisionally accepted, and there is a disposition not to reduce the amount of new plant unduly having regard to many consumers being engaged on war work.

Belfast: Position of City Electrical Engineer.—Once more a small section of members of the Corporation have tried and failed to secure the resignation of Mr. T. W. Bloxam, the City Electrical Engineer. For quite a long time there have been attempts to secure a reorganisation of the electricity department, but neither the Electricity Committee nor the Corporation seem to have the courage to boldly tackle the job. Each has put the task upon the other in turn, and it is impossible for the outsider to understand what is behind all this manoeuvring.

Chester: Electricity Profits.—There was a net profit of £3,194 upon the working of the electricity undertaking last year. Some members of the Council are inclined to cavil at the result, as it is the least satisfactory yet shown by the



department, and the complaint was made, when the accounts were before the Council, that instead of the Dee Hydro Works enabling larger profits to be made, the reverse would seem to be the case. The general consensus of opinion, however, is that, considering the war, the result of the year's working is quite satisfactory.

Dublin: *Conserving Capital Resources.*—The Electricity Committee, in their quarterly report, calls attention to the fact that there is only the sum of £9,500 available for house services, meters, etc., and it is anticipated that this will carry the undertaking on until the end of the year if care is exercised. Until a new loan can be obtained no new customers will be connected up except under very exceptional circumstances.

Gillingham: *Diminishing Capital Powers.*—The Electricity Committee has only £200 remaining with which to deal with mains and services. Owing to the difficulty of getting new loans, this sum is to be reserved for services.

Greenock: *Large Profits.*—The electricity undertaking shows a profit of £10,000 on last year's working, the largest in the history of the undertaking.

Kingston-on-Thames: *Electricity Deficit.*—There was a loss of £1,295 on the electricity undertaking last year.

Manchester: *Proposed Investigation Committee.*—The City Council did not deal last week with the notice of motion to which reference was made last week, time being too short, and the matter will come up for consideration at the next meeting a month hence.

Norwich: *Electricity Profits.*—Notwithstanding the war, there was a net profit of £8,013 upon the working of the electricity undertaking last year, although for the first time in its history there was a slight decrease in the total output. From the available balance the sum of £4,055 is taken to complete the scheme of work of a permanent character undertaken three years ago, and the remainder is carried forward. In spite of an increase in the cost of coal from 16s. 11d. to 17s. 4d. a ton, there was an actual saving of £706 for the year due to higher efficiency in the plant.

Waterford: *Electricity Scheme to be Postponed.*—As might have been expected the Local Government Board has intimated to the Corporation that their electric lighting scheme, all the details of which have been prepared and which was estimated to cost £30,000, must, in present circumstances, be postponed.

The cost of obtaining the Order amounted to £200, in addition to which the expenditure incurred upon engineering assistance amounted to £872.

West Ham: *Electricity Accounts.*—The output for the year to March 31st, 1915, was 35,641,945, compared with 34,404,791 in the previous twelve months. There was an increase of 2½ million units in the supply for power and heating, but a reduction of approximately one-fifth of a million units in the consumption for lighting and tramways. Nevertheless, the total increase of 3·6 per cent. must be regarded as satisfactory in the circumstances. The result for the year, however, shows a deficit of £8,852, compared with a profit of £751 in the previous twelve months. This is more than accounted for by expenses amounting to over £10,000 arising directly out of the war, whilst in addition there has been charged to revenue account the sum of £3,123 in connection with the reorganisation of main and side street lighting, new meters, electric vehicles, and obsolete switch-gear written off. The extra cost of coal alone amounted to £2,538. Attention is called to the fact that the motor hire business undergoes but little change, and it is pointed out that although the hiring facilities are still much appreciated by power users, it is found easier every year to sell motors outright, as confidence in the use of electric power is now so generally established. On June 30th last 22 per cent. of the staff had joined the Forces.

Wimbledon: *Electricity Accounts.*—There was a net profit of £2,184 on the electricity undertaking last year. Of this, however, £2,115 are absorbed in special charges.

Wolverhampton: *Satisfactory Electricity Accounts.*—The electricity accounts last year show a net profit of £7,444. The sum of £2,215 is to be transferred to relief of rates and the balance placed to reserve. The cooking apparatus installed is equivalent to 980 h.p. There was a materially increased output, although the net profit is about £1,000 less than in the previous years.

York: *Overhead Wires.*—The Old Earswick Council having refused sanction to the erection of overhead wires in their district, Mr. J. W. Haine, the Corporation Electrical Engineer, has intimated that it will be impossible to give a supply there owing to the prohibitive cost of underground mains.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

London Supply Companies' Dividends.—The following interim dividends have been announced : Westminster Electric Supply Corporation, 6 per cent. per annum; County of London Co., 5 per cent. per annum (2½ per cent. last year); Charing Cross Co. (West End undertaking), 4 per cent. (5 per cent. last year); Kensington & Knightsbridge Co., 3 per cent. (8 per cent. last year). Metropolitan Electric Supply Co., 1 per cent. (4 per cent. last year). City of London Electric Lighting Co., 6 per cent. (5 per cent. last year).

Yorkshire Electric Power Co.—Although there was an increase in net revenue for the half year to June 30th, the net profit, owing mainly to the war, was slightly less than for the corresponding period of last year, being £9,873 against £10,414. The directors have not declared an interim dividend on the ordinary shares.

Bombay Electric Supply & Tramways Co.—At the annual meeting last week the chairman had a satisfactory position to report for 1914, in spite of the inevitable adverse effects of the war. There was a net increase in revenue of 8·25 per cent. The electric supply branch has expanded in particular, notwithstanding the loss of certain mills to the hydro-electric power company, which, however, is restricted to supplying factories and railways where the consumption is of 500,000 units per annum and upwards. A recent issue of ordinary shares has been subscribed for by the shareholders at a premium of 26 per cent.

Victoria Falls and Transvaal Power Co.—There was a carry forward for 1914, after meeting the preference dividend to April 30th, 1914, of £106,447. At the Brakpan Power Station 33,500 h.p. of plant has been added during the year. There is now an ample reserve of compressed air and electrical plant.

FOR SALE AND WANTED.

CJENNINGS & CO. can supply woodwork of any description at short notice, Stairs, Balusters, Newels, Hand-rails, Sash bars, Mouldings, Joinery. Support BRITISH industry, and refuse Foreign doors. We compete. Electric casings and underground troughing also supplied. Send 1s. 6d. (export 3d. extra) for the most up-to-date illustrated list (286 pages) of woodwork and timber in the World, to include 4-fold, brass-jointed boxwood rule. Will return money in exchange if not worth 2s. 6d. to you. JENNINGS & CO., 955 Pennywell Road, Bristol.

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SUMMARY

A DESCRIPTION, with photographs, of a temporary 10,000 kw. electricity works at Birmingham appears on p. 346.

QUEEN ALEXANDRA has presented to the Institution of Electrical Engineers a pair of telephones given to Her Majesty in 1878 and used for several years in Marlborough House. We publish a photograph of these, and also give an account of some of the other apparatus collected for the Institution museum (p. 347).

A STRIKING instance where the substitution of 30,000 kw. turbo-generators for 7,000 kw. slow-speed alternators has been possible with increase of engine-room floor space is presented by one of the stations of the New York Interborough Rapid Transit Co., which is being remodelled (p. 348).

THE automatic telephone exchange at Newport has commenced working (p. 349).

A PORTION of the suburban lines of the L. & S.W. Ry. will soon be running under electric traction (p. 349).

THE running of auto-converters in parallel is referred to in our Questions and Answers columns (p. 349).

AMONG the subjects of specifications published by the Patent Office last Thursday are protective systems, metal filament lamps, wireless telegraphy, insulating material, telephone relays, and cables (p. 350).

AN Inventions Branch of the Ministry of Munitions has been formed. The panel of technical advisers contains several well-known electrical engineers. (p. 350).

THE Board of Trade award in connection with the demand by London wiremen for an increase in wages has been issued. The award is for a temporary increase to 11½d. an hour—not 1s. as forecasted in our last issue (p. 351).

A LOAN of £8,760 is contemplated at Ipswich; Barnsley has been authorised to borrow £15,220, and Darlington £26,100; a crane is required at Keighley, static transformers at Rochdale, and electrical goods by the West Ham Union and the Powell Duffryn Steam Coal Co. (p. 351).

THE Glasgow Electricity Committee are contemplating experiments in the gas firing of boilers.—New consumers are being refused at Dundee owing to lack of staff to lay mains.—The Surbiton electricity undertaking is to be transferred to Callender's Cable & Construction Co. (p. 352).

A 10 PER CENT. interim dividend is declared by W. T. Henley's Telegraph Works Co. (p. 352).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING AUGUST 28TH, 1915.
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, Wednesday, and Friday :—Drills 6.30 and 7.30.

Applications for Enrolment :—All applications for enrolment should be sent to the Commandant, Marconi House, Strand, from whom all particulars can be obtained.

E. G. FLEMING.

(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

We are informed that good work is being done by the various sections of the Corps, both in drill and the special technical work under the staff of the London Electrical Engineers (T.F.) for which this Corps has been organised. Arrangements for the use of a miniature rifle range with rifles and instructor are being completed, so that members will be able to take rifle practice at any hour of the day most convenient to themselves. Recruits will be welcome from all those who are willing to fit themselves by training for military engineering work; it is not necessary that they should be members of one of the Engineering Institutions, although the Corps has been organised primarily among the membership of the Institutions, and application from men with an engineering bent, even if in other occupations, will be entertained. Applications should be addressed to Lt.-Col. C. B. Clay, Marconi House, Strand.

A TEMPORARY 10,000 KW. ELECTRICITY WORKS

THE regular and rapid increase of load at Birmingham up to the middle of last year made it necessary to add an additional 5,000 kw. of plant at the Chester Street Power House, which, in conjunction with the one at Summer Lane, generates current for practically the whole of the supply at Birmingham. At the same time, plans and specifications were prepared for a large power house on a site at Nечеллс, which is a suburb about $2\frac{1}{2}$ miles from the centre of the City. This power house is to have an initial capacity of 15,000 kw. and an ultimate capacity of 100,000 kw. The plant capacity of the Birmingham Corporation Electric Supply Department will therefore ultimately total 146,500 kw. (Summer Lane, 36,500 kw.; Chester Street, 6,960 kw.; Water Street, 3,040 kw., and Nечеллс, 100,000 kw.).

Contracts for the foundations of the Nечеллс Station had already been let and piling for the foundations commenced,

Mr. Chattock kindly placed at our disposal. Fig. 1, taken on May 11th, and Fig. 2, on July 12th, show the very rapid progress made. In the latter view the relative positions of the building are seen. On the left is the switch-room, which has a building to itself, and is separated from the engine and boiler houses by an inclined way leading up to the Corporation Destructor Works, which occupies an adjoining site. The engine and boiler house are built against one another, the boiler house being the larger building on the right in Fig. 2. Between this building and the five cooling towers (four of which are seen in the illustration) there is a roadway 30 ft. wide. The dimensions of the buildings are approximately as follows: boiler house, 90 ft. by 65 ft.; engine house, 90 ft. by 60 ft.; switch house, 60 ft. by 28 ft.; with a small battery room, 43 ft. by 18 ft. adjoining. A steel-frame structure has been provided, filled in with a special corrugated asbestos-cement material (made by Thompson Hughes-Jones & Co., Budge Row, London, E.C.). This material, which resembles whitened corrugated

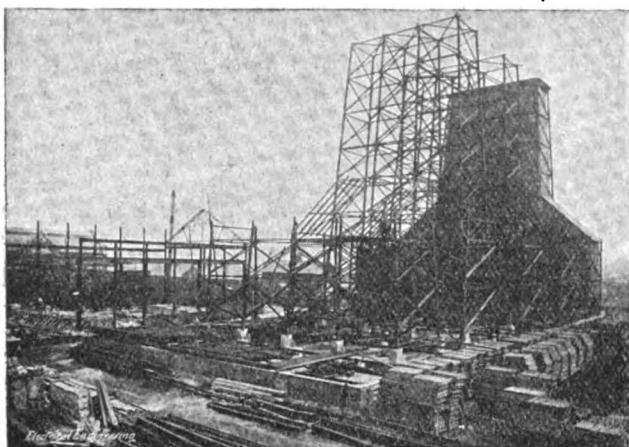


FIG. 1.—VIEW OF THE SITE ON MAY 11TH.

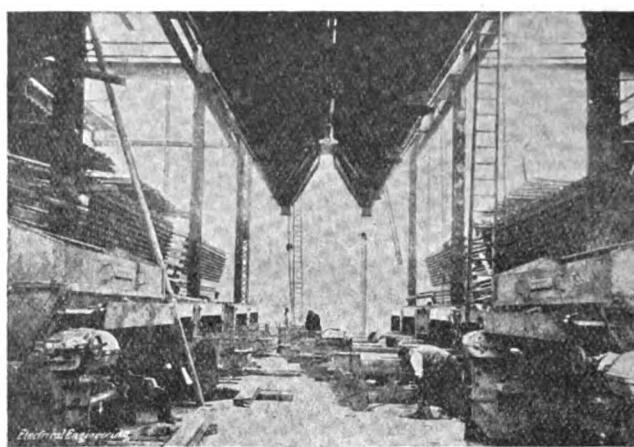


FIG. 3.—THE BOILER HOUSE, JULY 19TH.

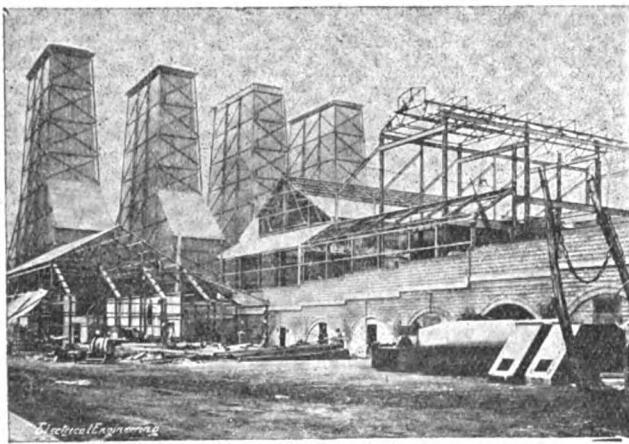


FIG. 2.—VIEW OF THE SITE ON JULY 12TH.

when it became evident that the abnormal growth of the load demanded would require new plant to be in operation far sooner than would follow in the ordinary course, and that it would be advisable to provide for the contingency of 10,000 kw. being needed in the coming winter.

As has been already recorded in our columns (*ELECTRICAL ENGINEERING*, Jan. 21st, 1915), Mr. R. A. Chattock, the City Electrical Engineer, solved the difficulty by deciding to erect a temporary station on ground adjoining the site acquired at Nечеллс, to get this into operation as soon as possible, and to utilise, so far as could conveniently be done, plant which would be ultimately destined for the permanent station. Work was commenced last January, and it is expected that the temporary station will be completed and in operation by October.

The site is "made" ground, and for the foundations a 12 in. raft of concrete, reinforced with expanded metal, has been employed, and the pressure upon this has been kept down to $\frac{1}{2}$ to 1 ton per sq. ft. The main stanchions have steel grillage foundations to reduce the weight.

We have selected a few views of the work during construction from an excellent collection of photographs which

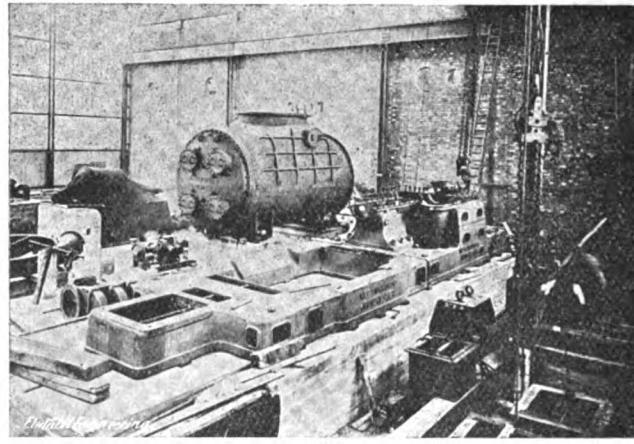


FIG. 4.—THE ENGINE HOUSE, JULY 19TH.

iron in external appearance, is employed for the partitions as well as the outside walls and part of the roofing; in the switch house glazing is only employed on the part not over the apparatus. The asbestos-cement is guaranteed for a life of at least twenty years.

Six Babcock & Wilcox marine-type boilers, each capable of evaporating 33,000 lb. of water per hour, are being put in. They will, of course, be used with economisers in the permanent station, but these are dispensed with at the temporary one. The Louis Prat induced draught system is employed. For the feed-water a large Clarke-Chapman direct-acting reciprocating pump, with a capacity of 25,000 gallons per hour, is being put in, and in addition two high-speed turbine-driven Worthington pumps. Above the boilers are twelve bunkers, each of ten tons capacity. A Herbert Morris telpher conveyor, which is being put in for the coal and ashes, spans the 40 ft. interval between the boiler house and the Birmingham and Warwick Junction Canal.

A large part of the steel work of the boiler house will be utilisable for the permanent building and also the telpher conveyor, but the engine house steel work will not come in to any very large extent for the larger engine house. The

magnitude and urgency of the temporary scheme can be gauged by the fact that the cost of the temporary foundations alone is estimated at £10,000.

In the engine-room two British Westinghouse 5,000 kw. turbine-driven sets are being installed, generating three-phase current at 5,500 volts, 25 cycles per sec. They will be supplied with super-heated steam at 200 lb. per sq. in., and the generators are to be air-cooled through two "wet" air filters, a Sturtevant and a Heenan & Froude. For each turbine there is a 200 h.p. turbine-driven air and circulating pump, arranged to exhaust either into a low pressure stage of the main turbine, or to ejector heaters in the hot well, or to the atmosphere.

A motor generator and rotary converter are being put in for the works supply and a small battery as stand-by, which also serves for working the trip-coils of the switch-gear.

Four of the five fine wooden Davenport cooling towers, over 100 ft. high, are seen in Fig. 2, and it is noteworthy that they were completed to the day of the contract period in spite of the difficulties of obtaining material and labour at the

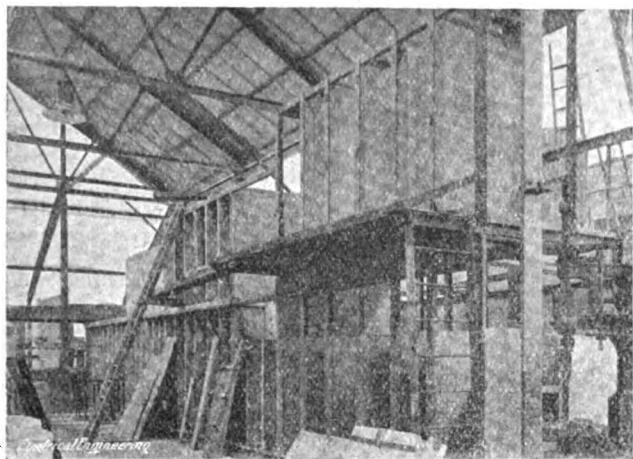


FIG. 5.—THE SWITCH HOUSE, JULY 25TH.

present time. Each can cool 185,000 gallons of water from 95° to 75° F. at 80 per cent. humidity of atmosphere.

The switch house will contain the control board as well as the high-tension switchgear itself, and is to be connected to the engine-room by a Chadburn telegraph. The gear is being supplied by the British Thomson-Houston Co. and follows their most modern lines. Moulded stone cubicles are employed, and, in accordance with present practice, large oil-cooled reactances are included in the generator leads. These reactances are placed at one end of the switch-room, and to prevent any risk of fire this portion, about 12 ft. in width, is walled off from the rest of the switch house with the similar asbestos-cement material as is being used for the rest of the building.

Two 0.25 sq. in. Callender split conductor feeders are being laid to the Saltley sub-station to start with, and four ring mains which run out to the district. Eventually the station will be run in parallel with the Summer Lane station, about two and a half miles distant at the other side of Birmingham.

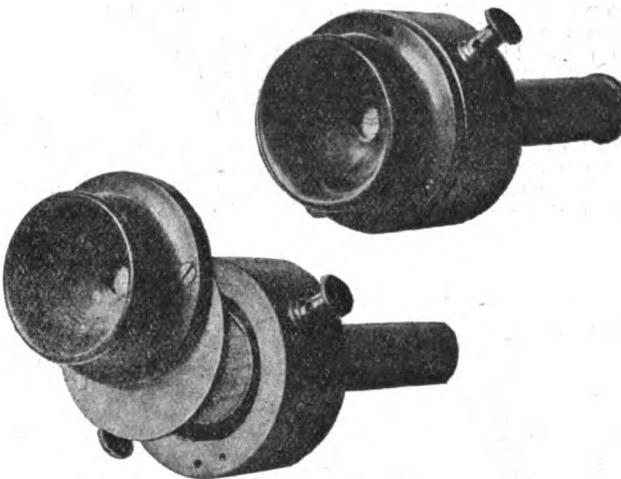
Our thanks are due to Mr. R. A. Chattock for permission to inspect the station, an inspection which was greatly facilitated by the courtesy of Mr. E. A. Mills, the Assistant Constructional Engineer, who is also responsible for the very excellent photograph of the interior of the switch house.

Fatal Shock from Trolley Standard.—An inquest was held last week into the death of a man named Hemingway, who worked as a car cleaner at Halifax. The deceased was found suffering from shock on the top of an open deck car with one hand on the trolley standard and the other on the rail, and died soon after. Mr. J. W. Galloway, tramways engineer, attributed the trolley standard being live to the fact that it had previously been damaged by lightning, which had pierced the insulation and fused the wire provided to earth the trolley standard. This wire was quite small, and the fusing of it was usually noticed and reported. It had not, however, been noticed on this occasion, and the car did not happen to have been examined before cleaning. Instructions have now been given to take the trolley off the wire before a car is cleaned. A verdict of accidental death was given.

THE INSTITUTION MUSEUM Queen Alexandra's First Telephones

THE Institution of Electrical Engineers is gradually collecting some interesting historical specimens of electrical apparatus, and the latest acquisition is a pair of telephone receivers presented to Queen Alexandra (then Princess of Wales) in 1878. Those who remember or have studied the history of the early days of telephony will remember that the invention of the telephone by Alexander Graham Bell in 1877 was followed by the manufacture of large numbers of telephones by amateurs, as the construction of the instrument was so easy and simple. Only one pair of instruments was used, as a rule, the same instrument being used for receiver and transmitter. The telephones which have been presented by Queen Alexandra to the Institution are of this class; they were made on H.M.S. *Thunderer*. We believe we are right in saying that they were taken into actual use between her Majesty's sitting-room and the schoolroom at Marlborough House for quite a number of years. The illustration below is from a photograph which we have had taken of the telephones, one being opened to show its construction. The cases are of boxwood, with terminals at the side. A pole magnet, very weak now and possibly not over strong then, passes inside the handle, and at the end is a fairly long coil of wire. Possibly the most interesting feature, in view of the fact that the instruments worked, is the very thick diaphragm, quite probably cut out of a thick ship's biscuit-tin.

In this connection, we may mention that the original telephone installed for Queen Victoria in 1878, between Osborne



House and Cowes, and worked therefore over about a mile of wire, is also in existence, and it is not improbable that Messrs. Julius Sax & Co., the present owners, will present it to the Institution.

The Institution has some other early specimens of telephone instruments, presented by the National Telephone Co., Ltd., among which is one of the so-called "electro-motograph" chemical receivers, used in conjunction with the carbon transmitter (invented simultaneously by Edison in America and Hughes in England), before the combination of the Bell-Edison Companies, when the Edison Company were unable to use the Bell telephone patent. The user of the instrument has to turn a handle which causes a chemically-treated chalk cylinder to revolve. A platinum-tipped tongue bears against the cylinder, and is fixed to a mica diaphragm. The friction on the cylinder varies with the current received, and causes the diaphragm to vibrate and to emit the sound of the voice—distorted in much the same way as in a gramophone. There is also a delightfully antique and very primitive exchange switchboard, but this is still in the basement of the Institution, and although its history must be interesting it is so far unrecorded.

Probably the most interesting piece of apparatus in the Institution collection is a Holmes magneto-electric machine, which was one of two installed in 1870 at Sowter Point lighthouse, and has actually been working the projectors there regularly until two years ago. It was received at the Institution last month, and, on account of its weight (between two and three tons) has had to be left in the basement.

The Institution has also been presented with two other historical machines, viz., the Gramme dynamo used for the first experimental street arc lighting on the Thames Embankment, and a Gramme machine which was in constant use for lighting the *Daily Telegraph* offices from 1882 to 1908.

Specimens of cable from the first English Channel and Atlantic cables down to the very latest loaded telephone sub-

marine cable, form an interesting collection, as do also the early incandescent lamps, switches, and fuses, presented by various members. One of the first syphon recorders has been given by the Eastern Telegraph Co. The collection of electricity meters, starting with zinc-zinc-sulphate electrolytic meter, in which the plates had to be weighed to ascertain the current consumption, is probably unique, although it has several gaps. There is also a Jablockhoff candle, but, to complete the apparatus used for the original Thames Embankment lighting, one of the holders used for these arc lamps would be valuable; if any of our readers has one in his possession, we are sure that the Institution would be most glad to receive it.

Mention must also be made of the telephone instruments used on the Scott Antarctic expedition, which were given back to Mr. Frank Gill when the survivors returned. A description of these instruments before they were sent out appeared in ELECTRICAL ENGINEERING, Vol. VI., page 427 (June 30th, 1910).

It will be seen that considerable progress has been made in collecting historical apparatus for the Institution museum, and it is to be hoped that opportunity will be found after the war is over and the Institution can take into use the rooms at present lent to the Government, that it will be classified and displayed in a suitable manner. A catalogue should also be posted there of the collection already existing at South Kensington, or, better still, if space will permit, this should also be housed at the Institution after the war, so that the whole may be under one roof.

30,000 KW. TURBO-ALTERNATOR

AN interesting example of the replacement of bulky reciprocating plant by turbo-generators giving many times the output in the same floor space is presented by the remodelling of the generating plant in progress at the 74th Street station of the New York Interborough Rapid Transit Co. The station, as originally equipped in 1901, contained eight Allis Chalmers horizontal-vertical cross compound engines, each driving a Westinghouse 7,000 kw. flywheel alternator running at 75 r.p.m., and a 7,500 kw. Westinghouse turbo-alternator was subsequently added. When the remodelling is complete the reciprocating plant will be replaced by eight 30,000 kw. turbo-generator units, raising the capacity of the station nearly 400 per cent. The comparative sizes of the old and new sets are shown in Figs. 1 and 2. According to the *Electrical World* two of the new 30,000 kw. turbo-generator units were in operation

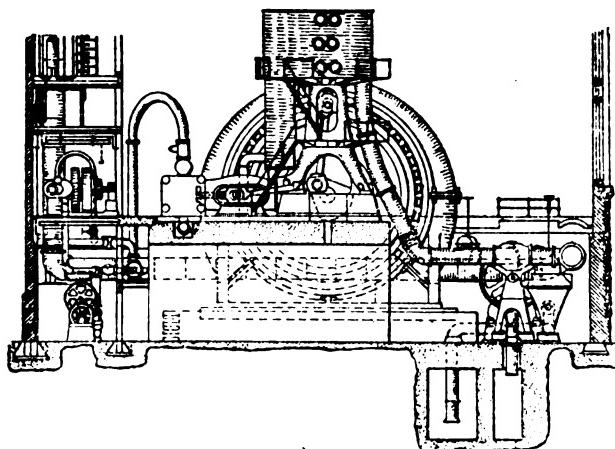


FIG. 1.—CROSS-SECTION OF ENGINE ROOM SHOWING OLD 7,000 KW. RECIPROCATING SETS.

last April, carrying all of the load except during the peaks, when the remaining 7,500 kw. turbine and four reciprocating engines are sometimes called upon for assistance. One unit is quite complete, and the second, while assisting in carrying the load, is undergoing an exhaustive series of tests. The foundations for the third unit are under construction. The portion of the alterations now in hand as a first instalment involve principally the substitution of three turbine generators for four engine generators; the making over of one-half of the boiler plant opposite the turbines by replacing Roney stokers with Taylor underfeed stokers, adding superheaters and removing the economisers; the partial replacement of motor-driven triplex with turbine-driven centrifugal boiler-feed pumps, and the complete rearrangement of the electrical switching system with the addition of current-limiting reactors.

Each 30,000 h.p. turbine set consists of a cross compound

arrangement of two turbines, comprising a 1,500 r.p.m. single-flow reaction turbine and a 750 r.p.m. double-flow reaction turbine, connected as a compound machine with a large receiver between the two. This arrangement was chosen to simplify design problems, particularly as regards temperature range, blade speeds, and steam congestion. The efficiency guaranteed is such that 75-75 per cent. of the heat energy available between admission and exhaust conditions will be delivered in electrical form. The turbines rest upon a foundation consisting of a steel frame incased in concrete, leaving most of the space below available for condensers, receiver, and pumps.

The Worthington surface condenser, of 50,000 sq. ft. cooling surface for each unit, is of the twin-shell type, of simple construction, and practically self-contained. The condensers are hung directly from the turbine bedplates, but their weight is supported on spring jacks. Circulating water for each pair of condensers is supplied by a pair of three-motor centrifugal pumps driven by steam turbines rated at 240 h.p. each. The condensate pumps for each unit are of the centrifugal type, turbine-driven and of 800 gallon per minute capacity each. One pump is sufficient, the second being a reserve. One reciprocating dry-vacuum pump is provided for each unit, with a capacity for two. The vacuum pumps are cross-connected between units.

In the boiler house the original boilers are being retained, but one-half are being rebuilt to the extent of adding standard B. & W. superheaters to give 200 deg. of superheat when

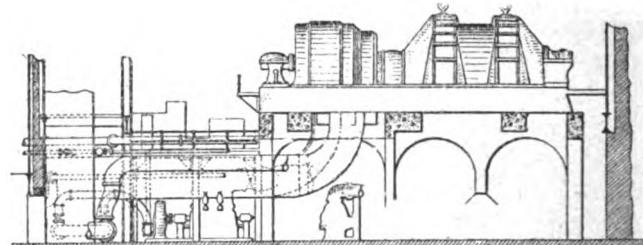


FIG. 2.—CROSS-SECTION OF ENGINE ROOM SHOWING NEW 30,000 K.W. TURBO-GENERATOR.

the boilers are delivering three times their rated output. The Taylor underfeed stokers which are being installed under one-half of the boilers are standard, but on four of the boilers air tuyères have been installed along the side walls, directing jets over the fires and protecting the side walls. As the remodelled boiler plant provides only superheated steam, provision had to be made for the auxiliary supply of saturated steam for the reciprocating engines. In the line connecting the old and new boiler plants is connected a receiver from one of the old engines. In the boiler-room basement much space has been saved by the removal of four triplex pumps, accommodating three turbine-driven centrifugal pumps sufficient in capacity for the entire plant and the stoker fans and turbines. For each pair of boilers there is one turbine driving two stoker fans direct and the stokers also through helical reduction gears from the blower shafts. In the basement ash pits of expanded metal plastered with cement have been recently put in.

The electrical distribution of the plant has been entirely remodelled with a view to providing adequately large switches, feeders, etc., and to protecting the underground cables from damage due to the large amounts of energy which will now be concentrated on short-circuit. There are two sets of buses, main and auxiliary, to which each old and new generating unit is connected. Between the generator and the main bus is a reactor with 5 per cent. reactance, and between it and the auxiliary bus is one with 2 per cent. reactance. The main bus is sectionalised through oil switches, groups of feeders being taken off from each section.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

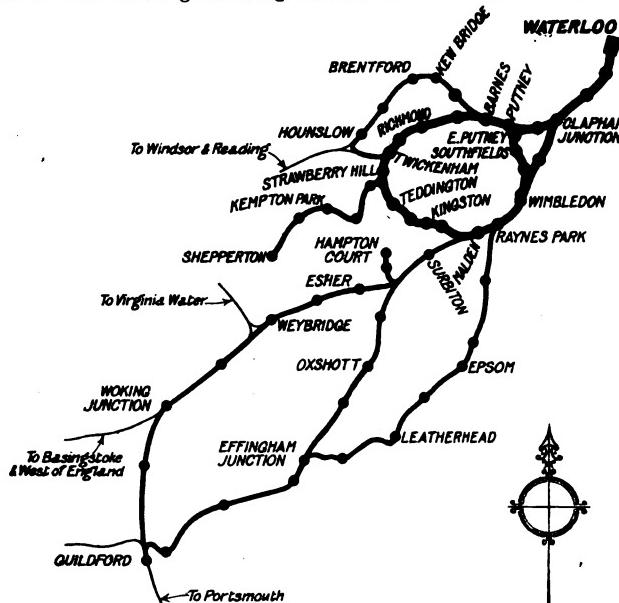
The new 2,000 line automatic telephone exchange at Newport (Mon.), which is so far the largest completed automatic exchange in the country, commenced working on Saturday. About 1,500 of the new instruments have been connected up. The exchange has been equipped by the Automatic Telephone Manufacturing Co., Ltd., on the Strowger system (see ELECTRICAL ENGINEERING, May 23rd,

1912, p. 278), which is already in operation at Epsom and at the Central Telegraph Office, London, and is being installed at Accrington, Portsmouth, and Chepstow. The other two automatic exchanges working are at Hereford (Lorimer system) and Darlington (Western Electric system). The Western Electric Co. have also exchange equipment in hand for Dudley, and automatic equipments on yet another system for Grimsby and Stockport are on order from Siemens Bros. and Co., Ltd.

According to a Reuter telegram from Tokio, wireless communication has been established between the new station at Funabashi, near Yokohama, and Honolulu, a distance of about 4,000 miles.

ELECTRIC TRACTION NOTES

The conversion of the suburban lines of the London & South Western Railway to electric traction is now in an advanced stage, and electric trains are to be put into regular service on the portion known as the Kingston loop (shown by thick lines in the map) in a few days' time, while the electrical working of the Hounslow, Shepperton, and Hampton Court and other sections will follow soon after, until the 140 miles of single track already equipped are in use. A frequent service of three- and six-coach trains will be run. Each permanently coupled three-coach unit will have a two-motor bogie at both ends and will take current at 600 volts from third and fourth rails. The main generating station at Durnsford Road, near



Wimbledon, is nearly complete and a portion of the plant is ready for running. It will have a capacity of 25,000 kw. and will be supplied with condensing water from the River Wandle. It will supply power at 11,000 volts to sub-stations containing rotary converters at Waterloo, Clapham Junction, Raynes Park, Kingston, Twickenham, Barnes, Isleworth, Sunbury, and Hampton Court. The sub-station buildings are all complete and the plant is in process of installation. The track conductor rails are of 100 lbs. per yard weight of a special high conductivity steel. The running rails are bonded and cross-bonded. Some further particulars of the scheme were given in ELECTRICAL ENGINEERING, December 13th, 1912.

The Hove Corporation has decided to dismantle the overhead equipment which was put up for the experimental trolley bus service in connection with a joint service for Brighton and Hove. Ever since Parliament sanctioned the scheme some years ago, the two Corporations have been unable to agree, and the Board of Trade had been asked to arbitrate. Now, however, a mutual agreement to abandon any further work until after the war has been come to.

The London & North Western Railway Co. has found no difficulty in raising £1,500,000 ten-year redeemable preference stock at 96, for the completion of the Euston-Watford Electric Railway.

The Chester Corporation is to purchase three 2-ton electric battery wagons at £3,200. The cost is to be spread over four years. A saving of £124 per annum is anticipated over the present system of refuse removal.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,456.

I wish to start up a 3-phase S.C. induction motor direct from an existing alternator without switchgear between the machines. Under these conditions, how will the torque of the motor vary with the speed? Is it necessary to separately excite the alternator field during the starting period? Are there any disadvantages in the method of starting?—M. M."

(Replies must be received not later than first post, Thursday, August 26th.)

ANSWERS TO No. 1,454.

Two 95-kw. auto-converters are being driven from a 500-volt system, and are supplying current at 300 volts to a motor load. When the machines are paralleled an equalising switch is closed. Until recently, the machines when started up built up to a pressure of 330 volts each and no trouble was experienced in paralleling them; but recently for some unknown reason one machine builds up to 350 volts. The result of this is, the equalising switch is burnt out after the machines have been operated a few times. What is the cause of this rise in pressure on one machine, and what is the best way to locate the fault and remedy it?—ESTIMATOR."

An award of 10s. is given to "Arch" for the following reply:

An auto-converter is in reality a motor and a generator coupled together electrically as well as mechanically; in fact, the motor and generator armatures are connected in series across the supply mains, whilst the load is across the generator armature only. There are several forms of auto-converters on the market, some with a single armature winding and split poles, some with a single core but two armature windings, others with two armatures, &c. Since "Estimator" does not state the arrangement of the machines referred to in the question, it is only possible to make some general remarks concerning his trouble.

The increase of voltage experienced on one of the machines must be due either to an increase in the speed or to an increase of the flux in the poles on the generator side of the set. If the poles have been tampered with, the above could respectively be accounted for by an increase in the length of the airgap under the motor poles, or a decrease in that under the generator poles. Other possible causes, such as a short-circuit of some of the armature turns on the motor side, or a change in the resistance of one or more of the field coils, could most easily be detected by comparing the resistances of the different circuits of the one converter with those of the other.

If no fault can be found with the windings, the simplest method (and the one generally employed on test-plates) of reducing the voltage to its correct value is to increase the length of the air-gap under the poles on the generator side, or decrease—if clearance permits—that under the poles on the motor side of the set. These alterations are accomplished by removing or inserting thin iron sheets at the back of the poles.

No other award is made.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published August 12th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,449/13. Protective System. E. G. WATERS. A protective system in which the cutting out of the faulty sections is effected by fault currents in two separate protective conductors for each cable section. These conductors are connected with tripping means at the ends of the cable sections. (One figure.)

29,981/13. Metal Filament Lamps. H. A. GILL (*Wolfram Lampen A.G.*). Incandescent lamps wherein a single conductor coiled into a close helix is looped to and fro over a number of supports like a plain wire filament in order to accommodate a great length of wire. The convolutions are arranged so that the axis of the helix is in a plane at right angles to the longitudinal axis of the lamp. (Three figures.)

11,102/14. Wireless Telegraphy. E. VON LEPEL. A method of producing high-frequency oscillations from a direct-current source by partially discharging a condenser by means of an auxiliary condenser of the same order of capacity, the charge of which is periodically reversed. The charging circuit is timed relatively to the frequency of the spark discharge, so that the voltage across the spark gap at the moment of discharge is approximately twice that of the D.C. source. (16 figures.)

11,112/14. Insulation. MEIROWSKY & Co. and J. M. MEIROWSKY. Manufacture of fibrous insulating material by compressing or rolling separate sheets previously impregnated with oil and provided with a layer of resin.

17,332/14. Incandescent Lamps. W. O. HUGHES. A lamp filament of annealed and wire-drawn uranium in a pure state produced by treatment of uranium tetrachloride with metallic sodium and potassium chloride.

275/15. Telephone Relay. WESTERN ELECTRIC Co. (*W.E. Co., U.S.A.*). A telephone relay system comprising an arrangement of a wave amplifier of the thermo-ionic or "audion" type with two separate cathode streams in one bulb connected so that one reacts to each half wave. (Five figures.)

4,761/15. Cables. BRITISH INSULATED & HELSBY CABLES, LTD., and J. BROTHERTON. Heavily sheathed rubber cables are provided with grooves or indentations in the covering at the point which comes inside the gland on entering a junction box so that the packing grips the cable and makes a watertight joint. (Eight figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: GREINACHER [Arc-incandescent lamp] 18,149/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: GROSSMANN [Insulating compound] 20,409/14; FOSTER [Attaching unarmoured cables] 3,213/14.

DYNAMOS, MOTORS, and TRANSFORMERS: SIEMENS BROS. DYN. WKS. [*Siemens-Schuckertwerke Ges.*] [Control of electric machinery] 3,658/14; PHENIX DYNAMO MNF. CO. and POHL [A.C. motors] 4,803/14; KENNARD [Electric motors] 7,342/14; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Squirrel-cage windings] 21,676/14; IMRAY (*Siemens-Schuckertwerke*) [Transformers] 22,243/14; NOLAN [Cooling dynamos and motors] 24,496/14.

Heating and Cooking: WHEELOCK [Water-heater] 22,150/14.

Ignition: LAW and TOVARISCHESTVO M. HELFFERICH SADET [Ignition devices] 17,849/14.

Incandescent Lamps: GLADITZ [Incandescent lamps] 3,209/14; BARON VON BÁTORKÉZ UND VERINKHÁZ [Machine for repairing incandescent lamps] 11,621/14.

Storage Batteries: VAN RADEN & CO. and METZ [Accumulators] 2,548/14.

Switchgear, Fuses and Fittings: IGRANIC ELECTRIC CO. (*Cutter Hammer Mnf. Co.*) [Motor controllers] 20,322/14.

Telephony and Telegraphy: SIEMENS & HALSKE A.G., LAIDLAW and PETTIGREW [Telephone system] 1,157/14; SIEMENS & HALSKE A.G. [Telephone register circuits] 11,211/14; SCHIESSLER [Antennae] 11,709/14; MELLERSH-JACKSON (*Fratelli Marzi di G.B.*) [Production of sustained oscillations] 12,259/14; ORLING and ORLING'S TEL. INSTR. SYND. [Telephone circuits] 17,920/14; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Coherers] 18,751/14; BLOXAM (*Teletypograph Ges.*) [Writing telegraphs] 20,137/14; IMRAY (*Siemens & Halske A.G.*) [Telephone register circuits] 1,006/15,

and [Selecting devices] 1,995/15; WESTERN ELECTRIC CO. (*W.E. Co., U.S.A.*) [Wave amplifier] 2,093/15; ELEKTRO-TECHNISCHE SPEZIALCONSTRUKTIONEN GES. [Thermic telephones] 4,353/15; TUBRI [Telephone instruments] 7,963/15.

Traction: VON KANDO [Overhead conductors] 1,452/14, and [Electrically driven vehicles] 4,233/14; VICKERS, LTD. (*Krizik*) [Train lighting] 4,681/14; HOBBHOUSE, SLINGO, GUNTON, POWELL and KINGSTON [Electric Railway Systems] 15,539/14; CROSSLEY [Electric carriage door locks] 17,511/14; DRINKELL and EVANS [Automatic signalling] 19,879/14; BILES [Petrol-electric traction] 6,805/15.

Miscellaneous: LUBACH [Indicator] 1,181/14; REICH [Fire-alarms] 4,188/14; STERLING TELEPHONE & ELECTRIC CO. (*Telephon-fabrik A.G. vorm J. Berliner*) [Signalling apparatus for mines] 4,223/14; VULCAN MASCHINENFABRIKS A.G. [Magnetic clutches] 17,455/14; BÜNTE & REMMLER [Vacuum cleaners] 17,628/14; KERR [Electric alarm connected with locks] 21,643/14; HOLZ [Electric concertina] 21,766/14; STILLE [Electro-optical cells] 1,973/15; F. KRUPP A.G. [Sparkless circuit interruption] 2,462/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, MOTORS, TRANSFORMERS, &c.: GIANDINOTO [Semi-static transformer] 10,518/15; EMIL HAEFELY & CO., A.G. [Vacuum drying and impregnating of coils] 10,803/15.

Heating: SAMSON APPARATE BAU-GES. [Thermostatic control] 10,734/15.

Ignition: DAIMLER MOTOREN GES. [Sparkling plugs] 10,204/15.

Instruments: LANDIS & GYR A.G. [Meters] 10,676/15.

Miscellaneous: DEUTSCHE SCHWEISSMASCHINEN BAU & VERTRIEBS GES. [Electric welding] 10,668/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: CROMPTON & CO., LTD., and C. F. TUBBS [Arc lamps] 9,693/06.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: W. E. LAKE (*P. Shröder*) [Cable armouring] 9,077/08.

DYNAMOS, MOTORS and TRANSFORMERS: T. VON ZWEIGBERGK [Motor control] 8,913/05; A. G. BROWN, BOVEY & CIE. [Constant current converter] 9,146/08.

Heating and Cooking: H. J. DOWSING [Folding electric light bath] 9,012/05.

Incandescent Lamps: E. A. CAROLAN (*G.E. Co., U.S.A.*) [Lamp exhausting] 9,590/03.

Switchgear, Fuses and Fittings: A.E.G. [Protective system] 21,603/08.

Telephony and Telegraphy: L. M. ERICSSON [Telephone ringing keys] 9,800/02 and [Telephone switchboards] 9,801/02; P. MULLIGAN [Telegraph instruments] 10,223/09.

Traction: COMPAGNIE DE L'INDUSTRIE ELECTRIQUE ET MÉCANIQUE [Railway motor control] 9,630/06.

Miscellaneous: E. C. and P. H. STEVENS and C. G. MAJOR [Lift control] 9,382/03; A. RICHARDSON [Electric sign with changing letters in relief] 9,008/08; M. A. NEWSTETTER [Automatically controlled independent lighting plant] 10,198/09.

A MUNITIONS INVENTIONS BRANCH

FOLLOWING more or less the example of the Admiralty, which recently constituted an Inventions Board, with Lord Fisher as Chairman (ELECTRICAL ENGINEERING, July 22nd, p. 310), the Minister of Munitions has created an inventions branch for his department. Mr. E. W. Moir, M.Inst.C.E., is comptroller, and the following have accepted an invitation to serve on a panel of honorary scientific and other experts:—

Colonel Goold Adams; Horace Darwin, F.R.S.; Macdougal Duckham; W. Duddell, F.R.S.; Sebastian Z. de Ferranti; Dr. R. T. Glazebrook, F.R.S.; Sir Robert Hadfield, F.R.S.; Professor J. S. Haldane, F.R.S.; Colonel N. B. Heffernan; Sir Alexander Kennedy, F.R.S.; F. W. Lanchester; Professor A. P. Laurie; Professor Vivian Lewes; Michael Longridge; W. H. Maw; Sir Hiram Maxim; Captain Moore, R.N.; Sir Henry Norman, M.P.; F. G. Ogilvie; Major-General G. K. Scott-Moncrieff; Wilfrid Stokes; James Swinburne, F.R.S.; Sir J. J. Thomson, F.R.S.; A. J. Walter, K.C.; C. J. Wilson.

This panel will assist the comptroller and his staff with the examination, investigation, and development of any projects that may be considered worthy of attention.

The address of the branch is Armament Buildings, Whitehall Place, London, S.W.

INCREASE IN LONDON WIREMEN'S WAGES

THE following is the text of the Board of Trade award issued last Friday in connection with the demand made by the electric wiremen in London for an increase in wages from 10½d. to 1s. per hour. It will be seen that 11½d. is awarded:

On the 9th March, 1915, application was made by the London District Secretary of the Electrical Trades Union to the London Electrical Masters' Association for an advance of wages from 10½d. to 1s. per hour, and a reduction of the working hours to 48 per week.

The Employers' Association intimated that they were unable to accede to this request, and these matters were therefore considered at a meeting of the Joint Committee of representatives of the parties on 30th April, and at a General Meeting of the Electrical Masters' Association on 10th May, but no agreement was arrived at on these questions.

On the 10th June application was made to the Chief Industrial Commissioner by the Secretary of the men's Union for the appointment of an arbitrator to decide upon the application for an advance of wages from 10½d. to 1s. per hour for electrical wiremen and fitters, with *pro rata* advances to electricians' labourers and assistants, it being subsequently explained that the question of the reduction of hours was unreservedly withdrawn.

After some negotiations the Employers' Association concurred in the reference of the matter to arbitration, and the Chief Industrial Commissioner having appointed me, David Harrel, to act as arbitrator in the matter, I heard representatives of the parties on 5th August.

After giving careful consideration to the statements and arguments made before me, I hereby award that the existing rate shall be raised from 10½d. to 11½d. per hour, with *pro rata* advances to electricians' labourers and assistants, such advanced rate to come into operation as from the beginning of the first pay day following the date hereof, and the advance now awarded to be regarded as war wages, and recognised as due to, and dependent on the existence of the abnormal conditions now prevailing in consequence of the war.

If any question arises as to the interpretation of this award it shall be referred to me.

(Signed) DAVID HARREL.

[We stated in our last issue that it was understood that the men had been given the increase from 10½d. to 1s. which they had sought. This turns out to have been incorrect. The Secretary of the Electrical Contractors' Association points out to us that he has been put to considerable inconvenience and annoyance by the very large number of firms who have communicated with him as a result of this announcement in our paper, and we can only express our sincere regret that this should have been the case through our having published information which has apparently emanated from an unreliable source.]

AN IMPROVED WEIGHING MACHINE

MESSRS. W. and T. Avery, Ltd. (Soho Foundry, Birmingham), have sent us some particulars of an improved weighing machine provided with an automatic ticket printing arrangement which should be very useful in preventing carelessness or fraud on the part of the weighman, and ensuring accuracy in weighing. The important feature is that the ticket printing mechanism is only unlocked when a balance has been obtained, and the cover closed and sealed so that no further alteration of the poises can be made. Another advantage of the machine, which is aptly named the "Stopfraud" is, that in cases where repetition weighments of say 1 cwt. sacks or packages are to be delivered and checked out, the poises can be set at 1 cwt., the machine locked by means of a padlock, and any untrained employee told off to check out any number of packages; it being quite impossible for overweight bags or lots to be sent out, since no ticket can be printed for weights that are even a fraction in excess of the specific variation which has been allowed in setting the machine. Again, when one package has been weighed, the ticket slot is absolutely closed against the insertion of a fresh ticket, and remains so until the package has been actually removed from the weighing platform. The firm has a scheme of maintenance contracts under which these machines can be supplied, and especially trained mechanics are available at the 150 branches and depots which Messrs. Avery have established throughout the British Isles.

Obituary.—Sec.-Lieut. W. A. B. Kirwan Ward is reported to have died from wounds received at the Dardanelles. Before the outbreak of war he had been since 1913 with the Relay Automatic Telephone Company (then called the Betulander Automatic Telephone Company), by whom he was employed in London and in France in connection with the installation erected in the Bois de Boulogne. His early experience was with the National Telephone Co. and for a short time he worked for the Constantinople Telephone Co.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Barnsley.—The L.G.B. has sanctioned a loan of £15,220 for plant extensions.

Basingstoke.—Mains are to be laid in various parts of the town where there are prospective consumers.

Darlington.—The L.G.B. has sanctioned a loan of £26,100 for extensions to deal with war requirements. The application was for £34,050, one of the items disallowed being £5,000 for mains.

Huddersfield.—The Meltham Council has approached the Corporation with regard to a supply of electricity.

Ipswich.—Some time ago the Corporation applied for a loan of £7,350 for sub-stations and equipment. The L.G.B. withheld consent until the actual cost could be ascertained more precisely. It is now found that the cost will be £8,760, and sanction to this amount is to be asked.

Keighley.—Overhead 40-ton travelling crane for Electricity Department. Borough Electrical Engineer. August 24th.

Rochdale.—Twelve months' supply of static transformers. Borough Electrical Engineer.

Wiring

Aylesbury.—Town Hall. Borough Electrical Engineer.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Ashton-under-Lyne.—Billiard saloon and shops. T. Calverley.

Miscellaneous

Australia.—The Sydney Corporation requires a supply of electric incandescent lamps. Commonwealth Offices, 72 Victoria Street, S.W. September 23rd.

South Wales.—Supply of electrical goods for Powell Duffryn Steam Coal Co. Secretary, 101 Leadenhall Street, London, E.C. September 8th.

West Ham.—Three months' supply of electrical fittings for Union. Clerk, Union Road, Leytonstone. September 2nd.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son of 5, Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £79 10s. to £80 10s. (last week £83 to £84).

"Century" Motors.—The agency for the "Century" single-phase motors has been acquired by the Swedish General Electric Ltd., Norfolk House, Cannon Street, E.C. (the London House of the Allmäna Svenska Elektriska Aktiebolaget of Västerås, Sweden) and the London stock of "Century" motors is now under their control. This department is being carried on by Mr. R. A. Marples, who for many years has represented the Century Co. in the United Kingdom.

Agency.—An agent at Lyons wishes to represent a United Kingdom manufacturer of electrical apparatus. Secretary, British Chamber of Commerce, 9 Rue des Pyramides, Paris.

Adnil Electric Co., Ltd.—In consequence of the decision of a Court of Appeal (ELECTRICAL ENGINEERING, June 10th, p. 247) that owing to the constitution and control of this



company—the directors being resident and the bulk of its share capital being held in Germany—it can no longer effectively carry on its business, a winding-up order has been made on the petition of a creditor. Mr. J. H. Stephens, of Messrs. Lescher, Stephens & Co., 6 Clement's Lane, London, E.C., has been appointed special manager pending the meeting of creditors, which will be held when the Courts reopen after the Long Vacation, and the services of Mr. S. G. Leach, one of the managers of the company, have been retained for the present. As mentioned elsewhere, the other manager, Mr. R. H. Marples, has joined the Swedish General Electric Co.

APPOINTMENTS AND PERSONAL NOTES

The estate of the late Mr. C. E. Spagnoletti is valued at £35,070.

An assistant electrical and mechanical shift engineer is required at the West Derby Union Hospital, Alder Hey, Salary, £2 per week. Clerk, Union Offices, Brougham Terrace, Liverpool.

Mr. W. Morgan, Professor of Automobile Engineering at the University of Bristol, has been liberated from his professional duties for the period of the war to take up munition work.

Instrument makers are required for urgent Government aeroplane work (see an advertisement on another page).

The Manager of a chemical works requires an assistant (see an advertisement on another page).

A switchboard attendant or improver is wanted at Perth (see an advertisement on another page).

LOCAL NOTES

Dundee: *New Connections Refused.*—The Electricity Department has given notice that owing to shortness of staff it is impossible to connect new consumers. Firms engaged on war contracts, however, will be dealt with.

Glasgow: *Electricity Committee's Report.*—We indicated a few weeks ago that the Electricity Department would show a loss of £459 on last year's working. The accounts themselves are now before us, and we see that this compares with a surplus of £819 on the previous twelve months. The revenue increased by £27,058, despite the abnormal conditions, but the working expenses increased by £17,621, principally due to an advance in wages to the men, a general overhaul of plant and mains, increased rates and taxes, and to a sum of £3,144, allowances to men on active service. A considerable increase in the contribution to the working fund has also to be noted on the additional borrowings, part of which is not as yet remunerative. As already stated, the charges for all classes of supply has been increased by 15 per cent. A gas-producer is being installed at the Port Dundas power station, and tests on gas firing of boilers are to be carried out. Work on the new Dalmarnock power station has been stopped during the war.

Hove: *Satisfactory Electricity Progress.*—The first year's working by the municipality of the old Hove Company's electric supply undertaking shows a net profit of £3,023. There was, however, a small deficit on the Aldrington undertaking, for which current is obtained in bulk from the Brighton Corporation, and the net profit on the two undertakings is reduced to £2,876.

Huddersfield: *Hired Arc Lamps.*—The local Chamber of Trade has been discussing the position of traders who have agreements with the Electricity Department for arc lamps on hire. Owing to the restriction of lighting, of course, these lamps have not been used, and the Corporation had charged half the amount with the agreement. This was objected to as there has been only six weeks' use of the lamps this year, and a settlement has been come to on the understanding that if half the charge is paid for the June half-year, no further charge will be made until the lamps are taken into general use again.

Ilkley: *Power Station Opened.*—The electricity supply works erected by the Council were formally opened last week. The capital expenditure contemplated upon the scheme is

£21,000, but at present only half of the plant has been installed. The remainder is on order. The present equipment consists of two 100-kw. generating sets.

Surbiton: *Transfer of Electricity Undertaking.*—The agreement for the transfer of the Council's electricity undertaking to Callender's Cable & Construction Co. has been sanctioned and the consent of the Board of Trade to the transfer is being sought. The Company has hitherto worked the undertaking on behalf of the Council.

Watford: *A Wiring Dispute.*—A case of some interest to electrical contractors came before the Watford County Court last week, when Mr. J. W. Russell claimed £41 17s. for work done at a private house in Bushey. The customer refused payment until the work had passed the Council's test, but as apparently no arrangement had been made for the electrical contractor to supply and fix fittings, the test obviously could not be made. The Borough Electrical Engineer gave evidence to the effect that so far as the work was completed it complied with the requirements of the Electrical Department, and in view of the fact that no arrangement had been made between the contractor and the customer for fittings, a verdict for the former was given.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

W. T. Henley's Telegraph Works Co.—An interim dividend at the rate of 10 per cent. per annum, less tax, is declared upon the ordinary shares for the June half-year (last year the same).

London Supply Companies' Dividends.—The Brompton and Kensington Electricity Supply Co. announces an interim dividend on the ordinary shares at the rate of 9 per cent. per annum, less tax, for the June half-year (last year the same).

The Electrical Trades Benevolent Institution.—Owing to the war, the Annual Festival of the Electrical Trades Benevolent Institution will not be held this year. Sir David Salomon, President of the Institution, has issued a letter pointing out that the cancellation of the Festival deprives the Fund of its chief source of income at a time when very heavy demands are made upon its resources. In these circumstances, he continues, the Committee confidently rely upon subscribers to renew their contributions upon an even more liberal basis than in past years. They also hope that the urgency of the claims made upon the Fund will bring a large influx of new subscribers.

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Orders should be addressed to the KILOWATT PUBLISHING CO., LTD. (Publishers of *Electrical Engineering*), 203, Temple Chambers, London, E.C., and should be accompanied by a remittance.

List of recommended electrical books on application.

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SUMMARY

THE arrangements for the centralisation of power supply to the London Underground Railways are well advanced. The City and South London Line is already run from Lots Road, and a similar course is to be taken in the case of the Central London Railway (p. 354).

THE advisability of setting the armatures of motors purposely a little out of centre is discussed in our "Questions and Answers" columns (p. 355).

A BOOK on Indian Electrical Engineering is reviewed (p. 355).

AMONG the subjects of specifications published by the Patent Office last Thursday were accumulator cells, incandescent lamps, variable speed A.C. motors, and wireless telegraphy. Application has been made for the suspension of two enemy-owned patents relating to electric bells. Patents on magneto ignition, electro-chemical processes and train lighting expire during the current week after a full life of fourteen years (p. 356).

A SHORT article sums up a few of the requirements which will have to be met if the electrical trade with South America, formerly held by Germany, is to be captured by our manufacturers (p. 357).

THE electrical equipment at a ball-bearing factory is described in an illustrated article (p. 357).

A REGULAR commercial wireless telegraph service

between Japan and the United States is soon to be opened (p. 357).

RECENT developments in heating and cooking apparatus, induction motors and fittings and accessories are referred to on pp. 358 and 359.

A 5,000 kw. and a 10,000 kw. turbo-generator are required at Shanghai; power station plant in Australia; H.T. mains at Stretford; battery at Horsham; telephone cable in New Zealand; and electric cranes at Sydney (p. 359).

MOTORS, heaters, and cookers will shortly be hired out at South Shields.—There has been a fire at the Belfast Electricity Works, due to an accumulation of gas over the coal bunkers (p. 360).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING SEPTEMBER 4TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday.—Drills, 6.30 to 7.30. Section 1, technical instruction. Sections 2, 3, and 4, squad drill, musketry, or signalling.

Wednesday.—No drill.

Friday.—Drills, 6.30 to 7.30. Section 3, technical instruction. Sections 1, 3, and 4, squad drill, musketry, or signalling.

Saturday.—2.30, promotion class. (Members wishing to join signalling class are requested to give in their names to their Section Commanders.)

Musketry.—Arrangements are being made for the various sections to go through a course of instruction at the miniature ranges in Greycoat Place; final particulars will be published later in supplementary orders.

E. G. FLEMING,
(Company Commander and Acting Adjutant.)

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Through A. Campbell Swinton, Esq., who is a director of Messrs. Crompton, Ltd., this firm has offered to the Corps a 24-in. projector barrel and stand, which has been accepted.

The Corps is still open for suitable recruits, either from members of the engineering institutions, or from others who desire to join an engineering unit and take advantage of the training available at the headquarters of, and under the staff of, the London Electrical Engineers (T.F.), who have kindly given every facility to this corps. Applications to Lt.-Col. C. B. Clay, V.D., M.I.M.E., M.I.E.E., Marconi House, Strand, W.C.

Capital Restrictions.—It is stated that in cases where extensions to electricity undertakings are imperative for the supply of power to firms engaged on war work, the Treasury has arranged with the London County Council to abandon many of the usual red-tape preliminaries in order that loans can be granted without delay. This applies, however, only to firms engaged on work directly concerned with the War Office or Admiralty.

POWER SUPPLY ON THE LONDON UNDER-GROUND RAILWAYS

ONE of the most important of the economies which have been rendered possible by the grouping of most of the underground electric railways of London under one administration is the possibility of supplying the whole of the lines from a single power-house equipped with large and economical generating units instead of the separate lines being supplied from their own stations on a smaller scale on which so high an efficiency was not attainable. The two pioneer tube lines, the City & South London and the Central London, have now for some time been under the control of the London Electric Railway Co., and already the former takes its power from the great station at Lots Road, Chelsea; while arrangements for the running of the Central London Railway from the same source are about to be made. The Lots Road station will then supply the whole requirements of the District, the Bakerloo, Piccadilly, Hampstead, City & South London, and Central London Railways, as well as a portion of the London United Tramways. The City & South London station at Stockwell has already been shut down, and before long the Shepherd's Bush station of the Central London will endure the same fate. A similar history befell the Great Northern & City Railway on being taken over by the Metropolitan Railway, resulting in its being now run from the large station at Neasden, which supplies the whole of the electrically-worked portion of the Metropolitan Railway. Thus the only underground line running from its own small station is the short Waterloo & City line, but it would surprise no one to learn that on completion of the London & South Western Railway Co.'s own large station near Wimbledon that the last of the historic small traction stations was to be shut down. The Great Western Railway have, of course, their own station at Park Royal, and the London & North Western Railway generating station at Stonebridge Park is fast approaching completion. This and the L. & S.W. station already referred to are already planned on a considerable scale, and may later be extended to a size unthought of at present as the success of the tentative schemes which they represent becomes fully demonstrated. It is, however, more particularly the change-over of the City & South London Railway that we wish to speak of now.

The City & South London Railway has a history of greater interest technically than any of the other lines of the group, in that it was the first electric "tube" railway in the world, and later presented the first example of three-wire distribution for traction. Opened in November, 1890, with a length of three miles, the line took its power originally from its own station at Stockwell, which contained what were then described as "three large Edison-Hopkinson dynamos" of an output of 202 kw. each, rope driven with the aid of jockey pulleys by Fowler vertical engines. This original station was later superseded by a new one almost alongside it, in which were installed originally two 800-kw. E.C.C. dynamos driven by slow-speed Cole, Marchent & Morley engines, and subsequently four Willans & Robinson engines, two of 500 h.p. and two of 210 h.p., also driving E.C.C. generators, a 550-h.p. Ferranti engine, and a Lentz 1,000-h.p. engine driving two generators. This brought the capacity of the station up to almost 4,000 kw. Originally, the track was fed direct at 500 volts, but with the extensions of the line to Islington and Clapham in 1900 and 1901 a higher transmission voltage was advisable, and the line was arranged as a three-wire system with 1,000 volts on the outers and the neutral earthed. Balancers and buffer batteries controlled by Highfield boosters were also installed in sub-stations. In connection with the northern end of the line, the equivalent of a five-wire system was employed by putting motor-generators in series with the pairs of 500-volt machines already in series in the station and transmitting at 2,000 volts to sub-stations at London Bridge and Islington, where further motor-generators converted back to the 2 x 500 volts at which the track was supplied. These arrangements continued in force until the moment of the change-over on June 13th, when power was first taken from Lots Road. For this purpose new 11,000-volt three-phase feeders were laid through the various tunnels from Lots Road to rotary converter sub-stations at Euston, Old Street, Elephant, and Stockwell; an additional 1,200-kw. rotary converter was put in at the Euston sub-station, which also feeds the Charing Cross, Euston & Hampstead Railway. The switchboard in this and the other combined sub-stations is arranged with the L.T. bus-bars divided so that the City & South London circuit is fed by separate machines, as the return is uninsulated and the track voltage is slightly lower. At the new Old Street sub-

station four 800-kw. rotary converters have been installed, and at the Elephant, which also feeds part of the Bakerloo line in place of the former sub-station at St. George's Circus, there are four 1,200-kw. sets. The new Stockwell sub-station, in a new building adjoining the old station, is not quite complete; it will contain two machines of the smaller size brought from Euston and two from St. George's Circus. All the new rotary converters, transformers, and switchgear in the sub-stations was supplied by the British Thomson-Houston Co. Pending the completion of the Stockwell sub-station, the southern end of the line is being fed from the Elephant, and an existing booster has been connected up temporarily to avoid an undue drop of pressure. When all this plant had been got ready, the actual change-over was a simple matter. Links were put in connecting up the new track feeders, and the new sub-station plant was run up on the morning of June 18th, while the old track-feeder switches were left open. In event of trouble, the old station could have been run up and put on the load without delay. Subsequently the old feeders have been disconnected, and the old station is ready to be dismantled when a purchaser is found for the plant. The sub-station batteries have been kept in commission for emergency lighting and lift operation. The ordinary lift and lighting circuits have been changed over to the new sub-stations in a similar way to the traction circuits. The whole of the station lighting is electric, and the gas lighting formerly relied on for emergencies has been removed. The scheme for enlarging the tunnels of the City & South London line and relaying the track to take the standard rolling stock as used on the other tubes has been temporarily abandoned owing to the war.

The problem of the conversion of the Central London Railway to supply from Lots Road will be met in a slightly different way. 11,000-volt feeders will be taken to Shepherd's Bush and transformers installed to reduce the pressure to 6,000 volts, which is the present generating pressure there. The frequency of the Lots Road supply is, however, different from that at Shepherd's Bush, being 39 $\frac{1}{2}$ instead of 25 cycles, and this will be met by making certain alterations to the rotary converters which will enable them to run at the correspondingly higher speed. It will be remembered that the Shepherd's Bush station, originally opened in 1900, represents the American practice of the time immediately preceding the steam turbine era, and contained six 800-kw. alternators run by slow-speed American engines, a 2,000-kw. alternator driven by a Musgrave horizontal engine was added later. It is interesting to note that the whole output of this station can be dealt with by a single turbine of the size in use at Lots Road. Historically the Central London is almost as interesting as the City & South London undertaking, as it was the first railway in this country to be run with a track voltage in the neighbourhood of 500 volts obtained from rotary converter sub-stations fed by a three-phase supply—a system which, with the exception of the single-phase lines of the London Brighton & South Coast, is now adopted on the whole of the electric railways and tramways in and near London.

Of the reduction in costs per unit consumed that is expected to be realised by the centralisation of power supply outlined above it is impossible to give any figures. The secret of the actual generating costs at Lots Road has always been carefully guarded. Nor is it necessary here to describe the equipment of the famous station in detail. It contains at present eight turbo-alternators rated at 6,000 kw., but capable of considerable overload capacity, and it is an open secret that a new 15,000-kw. turbo-alternator is practically complete, and that there is floor space for another set of like magnitude. (Some notes on the Lots Road power-house were given in ELECTRICAL ENGINEERING, Vol. IX., p. 341, June 12th, 1913.)

It should be mentioned that the arrangements for the changes in the power supply are in the capable hands of Mr. P. V. McMahon, who for many years was Engineer to the City & South London Railway, and on the taking over of that line, assumed the duties of Superintendent of Power in connection with Lots Road and Shepherd's Bush generating stations. It is through his courtesy that we have been enabled to put these notes together.

Defence against Torpedoes.—Mr. Emile Guarnini, writing from Geneva, tells us that he has devised an electrical system whereby torpedoes from submarines can be caused to deviate from their course and to explode prematurely. The invention is being submitted to the Governments of England, France, Russia, and Italy, and is said to be applicable to the defence of any ship.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practise. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,457.

I HAVE an electric drill, $\frac{1}{2}$ in. capacity, 110 volts, single-phase, squirrel cage rotor, and wish to run this off either A.C. or D.C., same voltage. The rotor has been wound and fitted with a commutator, and the machine runs fairly well as a repulsion motor, but does not develop full torque. As a series D.C. machine it gets excessively hot, after a few minutes' run; have tried various means of keeping cool, such as fans, &c., but without success. Are there any means I can adopt to enable this machine to be run satisfactorily as a repulsion or series machine on A.C. or series, or shunt on D.C. The frequency of A.C. supply is 60.—W. E. L. (Canada).

(Replies must be received not later than first post, Thursday, Sept. 2nd.)

ANSWERS TO No. 1,455.

Is it usual to make the air-gap length of large D.C. and A.C. motors and generators equidistant under all poles of a given machine, or is the gap less under the top poles? If the latter is the case, why is it done? How much is this reduction for various sizes and types of machine, and what calculation is this reduction based upon? What method is employed to set the machine out of centre?

The first award (10s.) is given to "A. R. T. C." for the following reply:—

In the earlier days of electrical engineering it was frequently proposed in erecting machines to make the top gap less than the bottom gap, so that the unbalanced magnetic pull would compensate, more or less, for the weight of the armature, thus reducing wear on the bearings. This idea was sometimes carried out, but the writer has not come across any modern machines so erected, nor does he know of any firm which now uses the method. There are several reasons why the idea would be inadvisable on modern machines. In the days of bipolar machines, setting the armature eccentrically did not result in unbalancing either electrically or magnetically. With multipolar machines unbalancing does take place. It is true that the armatures are usually provided with equalisers, but modern machines have been cut so fine that very often the equalisers have sufficient to do in compensating for the unavoidable variations found in the material, &c., without aggravating matters by decentralising the armatures purposely. Further, the mechanical design of machines has improved greatly, so that it is not a troublesome matter to take up wear in the bearings. Regarding alternators, there is no unbalancing caused by eccentricity of the armature, as may be seen by inspection of a winding diagram. The writer, however, has not come across any cases where the idea is carried out. With turbo-alternators there is practically no wear on the bearings, as forced lubrication is generally adopted. In induction motors the air-gap is made as small as possible, the limit being due to mechanical reasons. To decentralise the rotors, therefore, the gaps would require to be increased, thus

lowering the power factor of the machines, which is not desirable. The effect of eccentricity of rotors is discussed in most of the standard text-books, and approximate formulae are available, from which the magnitude of the unbalanced magnetic pull can be calculated.

The second award (5s.) is given to "W. H.," who writes as follows:—

In reply to the first portion of the query, I would state that it is customary to make the air-gap under the main poles of A.C. and D.C. motors and generators of the same length. There are occasions when the air-gaps under the poles at the top of the machine are made slightly shorter than those under the poles at the bottom of the machine. This is done so that the first wear of the bearings will tend to equalise the air-gap lengths, so that by this means machines such as induction motors, where the air-gaps are very small, will have a longer life before bearing renewals become necessary. As, however, the permissible wear in a bearing is only a few thousandths per inch of diameter, it will be seen that very little advantage is to be obtained in the D.C. motors and generators, where the air-gap is comparatively long. It is impossible to give any definite ruling as to the difference allowable between the lengths of the top and bottom air-gaps, but it can be made equal to half the permissible wear of the bearing, say half a hundredth for each inch of shaft diameter. In order to obtain these different air-gap lengths there are several common methods; one or two well-known firms, instead of turning a close-fitting spigot on the end shield, allow sufficient clearance to enable the air-gap to be altered by means of adjusting screws. This, of course, only applies to end-shield bearing machines. In other cases a packing piece or shim may be inserted between the top pole-pieces and the frame. This is the least satisfactory method, as the "grading" of the air-gap cannot be adjusted very nicely. In the case of pedestal bearing machines, the bearings are mounted on packing pieces or shims of the requisite thickness to raise the rotor through the necessary distance, the air-gap, of course, being checked in the usual manner by means of feelers.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Electrical Engineering in India. By J. W. Meares. 517 pp. $8\frac{1}{2}$ in. by $5\frac{1}{2}$ in. 74 figures. (Calcutta: Thacker, Spink & Co.; London: W. Thacker & Co.) 15s. net; abroad, 15s. 9d.

The title of Mr. Meares's book takes our thoughts back to a dear old gentleman of Dutch nationality whose English would have been nearly perfect if there had been no prepositions. Years before his death he had become famous for the following remark to a guest who had only been able to arrive after dinner: "We were eleven on the table, and we regretted that you were not under us." If we except the title, the grammar of Mr. Meares's book is perfect, but it should have been labelled "Electrical Engineering for India," and not "Electrical Engineering in India." The Indian reader will, to be sure, find in it exactly what he expects, namely, a practical book of electrical engineering with the conditions peculiar to India always in view. On the other hand, the English electrical engineer who is led by the name of the book to anticipate a description of electrical plant and engineering methods in India, with highly technical practical advice as to the modifications which should be made in home practice in design, construction, and erection to meet Indian conditions, will be disappointed. The work is, in fact, primarily intended to give civil engineers of the Indian P.W.D. and students destined for the service a useful knowledge of electrical engineering. Incidentally it also serves to some extent as a price book, as the cost of various items of electrical plant and accessories in India are included in some of the tables of sizes.

A few errors (chiefly due to the Indian printers) and omissions are almost inseparable from a book of this character written away from home, but they are not of such importance as to impair the utility of the work to any serious extent. On the other hand, many writers in England might follow Mr. Meares's lead with advantage in the choice of matter for a technical book dedicated directly to the practical worker.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published August 19th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

2,548/14. Accumulators. VAN RADEN & Co., LTD., and M. MERZ. Accumulator cells, more especially intended to supplement celluloid for use in hot climates, made of a lead-antimony alloy with a cover of glass, through which the interior of the cell can be inspected where there are holes in the lead framework. (Six figures.)

3,209/14. Incandescent Lamps. C. GLADITZ. Lamps with a filament support of silica of substantially triangular section, but with concave surfaces, round which is wound a wire filament previously coiled into a tight helix. (Three figures.)

4,803/14. A.C. Motors. PHOENIX DYNAMO MFG. Co. and R. POHL. A variable-speed A.C. motor for driving winding engines and other work in which both the inner and outer members are capable of rotation. Each is connected mechanically and electrically with the armature of an auxiliary machine having a series characteristic, and the speed regulation is effected by controlling the fields of the auxiliary machines by diverters. (One figure.)

11,621/14. Lamp Repairing. BARON A. O. VON BÁTOKÉZ UND VERINKHÁZ. A machine for cutting off the lower part of used lamp-bulbs in order to replace the filaments. The lamp is gripped by a self-centring holder and rotated, and provision is made for making a scratch by a diamond and causing alternate blasts of hot and cold air to impinge upon the part to be cut. (Four figures.)

12,259/14. Wireless Telegraphy. W. J. MELLERSH-JACKSON (*Fratelli Marzi di G.B.*). A device for the continuous production of sustained oscillations by means of a "crackling" arc between a rod electrode and an electrode in the form of a rotating metal drum kept moist by a jet of liquid. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: LIBANO [Insulator for overhead lines] 12,443/14; BEAVER and CLAREMONT [Cables] 19,882/14; W. T. HENLEY's TELEGRAPH WKS. Co., LTD. [Distribution] 6,117/15.

DYNAMOS, MOTORS, and TRANSFORMERS: SIEMENS BROS. DYN. WKS., LTD., and KIEFFER [Rotors] 14,278/14; SIEMENS BROS. DYN. WKS., LTD. and KOETTGEN [Starting rotary converters, &c.] 14,378/14; MEIROWSKY & Co. and FISCHER [Transformers and other high-tension apparatus] 14,483/14; SIEMENS BROS. DYN. WKS., LTD., and KIEFFER [Windings] 15,958/14; ANDERSON and ATCHLEY [Speed control] 22,897/14.

Ignition: RALL [Sparkling plugs] 14,561/14.

Incandescent Lamps: GLADITZ [Incandescent lamps] 13,541/14; TRENNEN [Rendering tungsten ductile] 14,381/14; A.E.G. [Incandescent lamps] 18,566/14; GLUHFÄDENFABRIK AARAU A.G. [Ductile tungsten] 23,496/14.

Instruments and Meters: SZILARD [Electrometers] 16,945/14.

Switchgear, Fuses and Fittings: SIEMENS BROS. DYN. WKS., LTD. (*Siemens-Schuckertwerke*) [Cartridge fuses] 12,210/14; MELLERSH-JACKSON (*Geb. Jaeger*) 12,682/14; SIEMENS-SCHUCKERTWERKE [Starters and controllers] 17,949/14; B.T.-H. CO. YOUNG and WATSON [Relays for voltage regulators] 18,497/14; SIEMENS-SCHUCKERTWERKE [Switches] 18,502/14; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Resistances] 18,685/14; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Circuit breakers] 21,785/14; IGRANIC ELEC. CO. (*Cutler-Hammer Mnf. Co.*) [Motor controllers] 23,366/14; MELLERSH-JACKSON (*Soc. Anon. Moro*) [Circuit breakers] 24,039/14; MARKT [Switches and couplings] 6,222/15.

Telephony and Telegraphy: SIEMENS BROS. & Co., LAIDLAW and GRINSTEAD [Telephone exchange circuits] 3,902/14; SIGNAL GES. [Wireless radiating system for aeroplanes] 13,520/14; SIEMENS BROS. & Co. (*Siemens & Halske*) [Telephone circuits] 15,471/14; SIEMENS BROS. & Co., PETTIGREW & CHRISTIAN (partly *Siemens & Halske A.G.*) [Telephone circuit selecting

devices] 15,546/14; DEUTSCHE TELEPHONWERKE [Wireless detector] 15,881/14; BLESSING [Telephone systems] 18,033/14; BLOXAM (*Telepantograph Ges.*) [Writing telegrapher] 18,290/14; SIEMENS BROS. & Co. and PETTIGREW [Automatic telephone circuits] 18,565/14; STERLING TELEGRAPH & ELECT. Co. and WARD-MILLER [Telegraph key] 5,089/15.

Traction: SIEMENS BROS. & Co., LTD., and Boor [Railway signalling] 11,715/14; SIEMENS BROS. & Co. (*Siemens & Halske*) [Signalling] 11,940/14; SIEMENS-SCHUCKERTWERKE [Regenerative braking] 13,136/14 and [Tightening overhead conductors] 13,213/14; GES. FÜR ELEKTRISCHE ZUGBELEUCHTUNG [Train lighting] 13,553 and 13,554/14; SCHUSTER [Railway signalling] 14,136/14; SIEMENS-SCHUCKERTWERKE [Tensioning arrangements for overhead conductors] 14,683/14; SIEMENS BROS. & Co. (*Siemens & Halske A.G.*) [Control of points] 15,642/14; THOMPSON [Signalling] 18,433/14.

Miscellaneous: RALPH [Gas detection apparatus for mines] 10,110/14; NORMA COMPAGNIE [Magnetic chucks] 11,993/14; A.E.G. [Electric welding] 12,479/14; ANSCHÜTZ & Co. [Gyroscopic compasses] 12,959/14; SIEMENS-SCHUCKERTWERKE [Searchlight projectors] 13,920/14; SIEMENS BROS. & Co. (*Siemens & Halske*) [Interrupting devices] 15,871/14; SIEMENS-SCHUCKERTWERKE [Signalling arrangements for searchlights] 18,123/14; COLLEY [Electric hoisting apparatus] 18,302/14; SIEMENS BROS. DYN. WKS., LTD. [Distant control of searchlights, guns, and other apparatus] 18,466/14; RAILING and ANGOLD [Reflectors for miners' lamps] 22,227/14; B.T.-H. CO. (*G.E. Co., U.S.A.*) [Vibrating rectifiers] 23,121/14; ADICKES [Binding posts] 24,429/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear: R. BOSCH [Pedal switches] 2,236/15.

Traction: SOC. ANON. DES ÉTABLISSEMENTS L. BLÉRIOT [Vehicle installations] 8,466/15; BETHENOD [Lighting magnetos].

Miscellaneous: MÖLLER [Separation of dust, &c., from gases] 11,088/15.

Application for Suspension of Enemy Patents

27,457/07 and 19,199/10. **Electric Bells.** C. HERRDE. An application by J. Warner & Sons will be heard on Sept. 1st. The first of these specifications describes mechanism for large electric bells with heavy hammers, and the second describes a separate periodic contact maker and breaker for this class of apparatus.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

17,249/01. Magneto Ignition. F. R. SIMMS and R. BOSCH. Magnets with stationary armature and field magnets, and a moving inductor sleeve surrounding the armature.

17,520/01. Electrochemistry. P. E. C. CORBIN. Electrochemical production of chlorates, perchlorates, bromates, iodates, &c., from solutions containing chromic acid.

17,482/01. Train Lighting. A. B. GILL. A number of improvements in detail of a previously patented electric train lighting system.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS and TRANSFORMERS: C. A. PARSONS, A. H. LAW, and J. P. STOCKBRIDGE [Commutators] 10,588/09; A. E. G. [A.C. motors] 10,663/09.

Instruments and Meters: SIEMENS BROS. & Co., E. F. LAUKERT, and J. NEBEL [Instrument switches] 10,550/09.

Switchgear, Fuses and Fittings: FELTEN & GUILLAUME LAHMEYERWERKE [Protective system] 9,844/08.

Telephony and Telegraphy: G. C. M. HARDINGHAM (*Felten & Guillaume*) [Loaded telephone cables] 10,296/03.

Traction: W. KÖHLER [Overhead collectors] 26,807 and 26,808/09.

Miscellaneous: A. C. E. RATEAU [Control of electrically-driven centrifugal feed pumps] 7,999/05; G. WOLTERS [Electric miners' lamps supplied by self-contained dynamo driven by compressed air] 10,312/09.

TRADING WITH SOUTH AMERICA

A N. article in the *Electrical Record* (Canada), which has been sent us by Mr. F. A. Cambridge (City Electrician, Winnipeg), deals with the situation as regards electrical trade with South America. One of the principal characteristics of the Latin population of the South American States, in the author's opinion, is that he would rather pay an increased 10 per cent. in price and enjoy a six months' credit, than to be deprived of this credit and compelled to pay cash. The inability to recognise this trait, and the refusal to humour it as other nations have done, is one reason why we are not getting the benefit of the South American trade at present. Nearly all the electrical apparatus in use is of European manufacture, mostly German, though a quantity of French, Belgian, and British material is used. The United States is represented by the General Electric and Westinghouse Co.'s who do considerable business. The bayonet lamp socket and base are used in preference to the Edison. American manufacturers are now making great efforts to capture the trade, at any rate temporarily lost by Germany. With regard to the electric supply situation, with the exception of the very powerful companies controlling the electrical supplies of Buenos Aires and Montevideo, which are German, the larger part of the balance is controlled by British capital. The Lacroze Co. in Buenos Aires, controlling a large electric and steam railway service, is native. All steam-driven stations use imported machinery, coal, oil, and other supplies.

It is highly important, continues the author, that all correspondence between the exporter and his South American client, as well as all shipping documents or other papers relating to South American shipments, should be written in the language of the country to which the goods are exported. For all, with the exception only of Brazil, Spanish is the official language. For Brazil it is Portuguese.

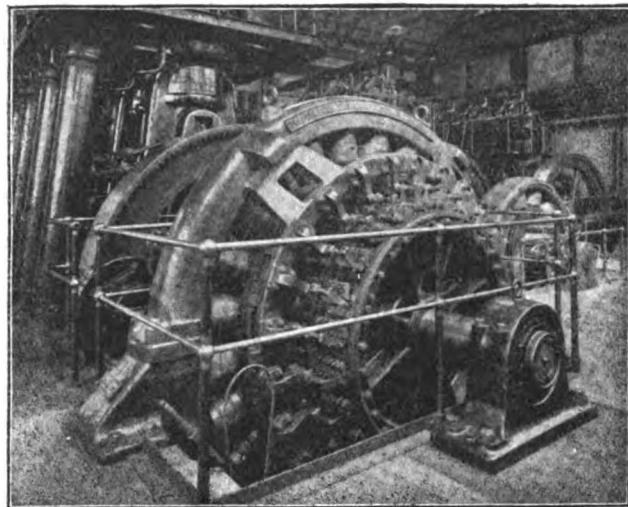
The Germans, in his opinion, have obtained and hold the electrical and many other trades in these South American countries for the following reasons: they meet the wishes and peculiarities of the people whose trade they seek; they send them literature in their own language, and give information as to dimensions, weights, and prices in the metric system; they take every care in packing, shipping, and preparation of documents, to cause the customer the least possible trouble, and conform to the local customs laws; they send representatives to interview customers and obtain their business, representatives who are painstaking, polite, indefatigable, and who speak to the customer in his own tongue, not compelling him to produce someone to act as interpreter; they have tact enough to gratify the Latin pride by extending him credit without letting him know he is paying for it; and finally, because the German ships these goods when once sold to the customer, in German ships, under the German flag, at much lower freight rates than the customer could obtain from a British ship trading between the same ports.

The British controlled this trade in 1896. In 1906, just ten years later, they had lost the greater part of it to Germany. The British had the ships, but they would not depart from established customs in business, language, currency, or weights and measures, preferring to force these upon the Latin, who was reluctantly compelled to accept them. When the German entered the field and humoured the Latin, the German promptly secured the trade. Our manufacturers, he insists, will have to pay greater attention to these matters in order to claim and hold the trade that is theirs if its acquisition is set about in the right way.

ELECTRIC SUPPLY IN A BALL BEARING FACTORY

IN the works of the Hoffmann Manufacturing Co., Ltd. (Chelmsford, Essex), power is supplied for driving the machinery at 110 volts. In consequence, the generators are called upon to supply very heavy currents. These machines are driven by Diesel engines, and in the first installation comprised two 220-kw. "Witton" generators, coupled to three-cylinder Diesel engines, having cylinder dimensions of 450 mm. diameter \times 660 mm. stroke. A recent addition to the plant took the form of a 700-kw. "Witton" generator driven by a four-cylinder Diesel engine, with cylinder dimensions of 510 mm. diameter \times 660 mm. stroke. This engine has water-cooled pistons and cylinders. Naturally, such a machine, running at the low speed of 187 r.p.m., had large dimensions, and the problems involved in its construction can be realised by the fact that the full load current of the generator is 6,400 amperes. Special care was taken in the design and construction of the commutator and brush gear, a double commutator being adopted to carry the heavy current. That the General Electric Co., Ltd., were successful in its construction is evident from the fact that the generator runs continuously throughout the week without giving the slightest trouble. An interesting feature of the

installation is the fact that the machines are equipped with "Hoffmann" roller bearings, a fact which no doubt contributed to their satisfactory performance. The generators



THE 700-KW. "WITTON" GENERATOR, FITTED WITH HOFFMANN ROLLER BEARINGS, AND DEVELOPING 6,400 AMPERES.

for this installation were supplied by the General Electric Co., Ltd., of "Witton," Birmingham, and 67 Queen Victoria Street, London, E.C.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

At an extraordinary meeting of Marconi's Wireless Telegraph Co. last week to confirm a resolution dealing with the appointment of directors, &c., Mr. G. Marconi, referring to the establishment of wireless telegraphy between the United States and Japan, said that a regular commercial service will soon be opened between these points. This brings the company considerably nearer to the completion of its general programme, viz., the establishment of wireless communication right round the world.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"The Rare Earth Industry," including the Manufacture of Incandescent Mantles, Pyrophoric Alloys, and Electrical Glow Lamps. By S. J. Johnstone. Together with a chapter on The Industry of Radioactive Substances. By A. S. Russell. 136 pp. 10 in. by 6½ in. 42 figures. (London: Crosby, Lockwood & Son.) 7s. 6d. net; abroad, 8s. 1d.

"Specification and Design of Dynamo-Electric Machinery." By M. Walker. 648 pp. 10 in. by 6½ in. 533 figures. (London: Longmans, Green & Co.) 32s. net; abroad, 33s. 4d.

Water-Power Development in Canada.—According to the (Canadian) *Electrical News*, within the provinces of the Dominion and excluding the North-West Territories, practically all of the Yukon and the northern and eastern portions of Quebec, it is estimated that 17,764,000 h.p. are available, this amount being inclusive, in the case of Niagara Falls, Fort Frances, and the St. Mary's River at Sault Ste. Marie, of only the development permitted by international treaties, and, further, does not contemplate the full possibilities of storage for the improvement of capacities. The developed powers, which are inclusive of all water-powers, whether for electrical production or for other uses, aggregate 1,712,193 h.p. as developed by turbines. The *Electrical Review and Western Electrician* reports that the Ontario Hydroelectric Power Commission is about to undertake an additional development of about 100,000 h.p. at Niagara, to be increased later to 250,000 h.p.

HEATING AND COOKING APPARATUS

THE new autumn list of electric heating and cooking appliances issued by Ferranti, Ltd. (Central House, Kingsway), is a very complete production. It opens with a reprint of a paper read before the Birmingham Electric Club on electric heating and cooking by Mr. R. Weaving. Two main types of electric fires are included, each in a number of different forms, embracing some very artistic as well as utilitarian designs. The cone fire employs the heating element shown in Fig. 1 mounted in some cases in the centre of a reflector, and the other type is fitted with the bar unit, with its zigzag arrangement of a helical wire held by parallel porcelain bars strung on two rods. Like the cone element



FIG. 1.—CONE FIRE ELEMENT.



FIG. 2.—IRONCLAD THREE-WAY SWITCHBOARD.

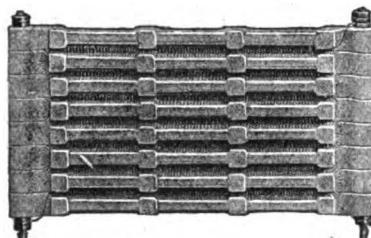


FIG. 3.—OVEN ELEMENT.

these are easily replaceable. These fires are listed up to 3 k.w.

Interchangeability of heating elements is also a feature of the cooking apparatus from the single heating plate with the well-known Ferranti disc element to the largest ovens. The number of designs of grills, breakfast cookers, ovens and complete cooking ranges already standardised, is too large to particularise here, but we may remark that all the apparatus shows a robustness, simplicity, and attention to details such as is not always to be seen. The oven element (Fig. 3) is not unlike that used in the bar fire, and particular attention should be drawn to the neatly designed switchboards such as that in Fig. 2, which are usually connected by wires in stout metallic flexible tubing to the apparatus in the case of the larger outfits.

INDUCTION MOTORS

THE latest types of two- and three-phase induction motors manufactured by the British Thomson-Houston Co., Ltd. (Rugby), ranging from the smallest squirrel-cage machines to large motors of many hundreds of horse-power, are described and illustrated in a new list just issued by the company. A great deal of useful information is included, and the patterns of machine dealt with include, besides the ordinary protected forms, with large apertures in the end shield, special drip-proof, enclosed ventilated, pipe ventilated, and totally enclosed designs, as well as a pattern with slip rings only enclosed in a flame-proof chamber. Other special machines illustrated in the pamphlet are large motors with flywheel-type rotors and pedestal bearings, and vertical shaft machines. It is noticeable that all except the smallest machines have provision for adjusting the air-gap after wear of the bearings, and a number of other patterns show the completeness with which detail has been studied in the designs. The terminal box arrangements, for example, are a great advance on what we have been accustomed to in the past. A useful graphical method is employed to indicate suitable sizes of pulleys and pinions, and the tables of dimensions, shipping specifications, &c., show the same care in their preparation as the rest of the work.

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THE ALL-BRITISH
ELECTRIC LAMP

BRITISH MADE BY
BRITISH LABOUR IN A
BRITISH FACTORY WITH
BRITISH CAPITAL

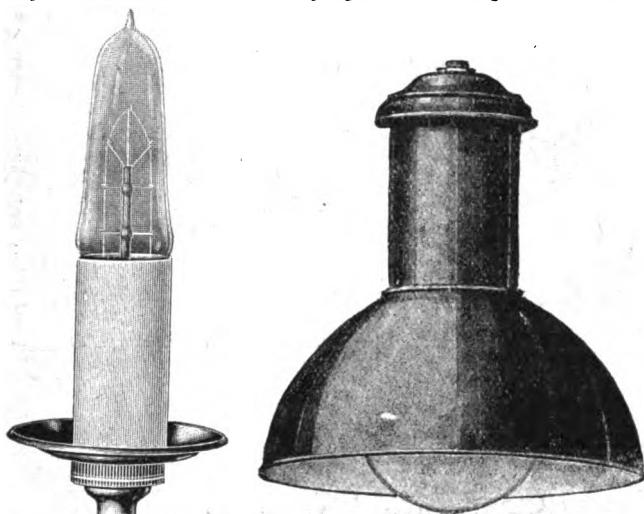
FITTINGS ACCESSORIES

THE latest catalogue published by the General Electric Co., Ltd., deals with electric light fittings accessories. In its 68 pages it illustrates and describes all the established types of accessories and a large number of novel designs of a variety which it is impossible to particularise in detail. In addition to the well-known types of "Superlux," "Holophane," and "Equiluxo" glassware, the catalogue includes a comprehensive list of cardboard, fancy silk and fancy glass



WINDOW SIGN.

shades, many of entirely new patterns. The chain section, which deals with tubes, nurls, and "S" hooks, in addition to chains, has been enlarged by the inclusion, among other novelties, of a new pattern rectangular link chain, and three patterns of Cash's ornamental patent chain. One of the most important divisions is concerned with reflectors for shop-window and show-case illumination which enable the special regulations as to not throwing light on to the pavement to be



DWARF CANDLE.

"ORDNANCE" LANTERN.

complied with while concentrating the light in the most efficient way possible. Associated with the problem of shop-window lighting is the installation of electric signs. Various types of signs are included, and special attention is given to window signs which may be used in conformity with the present regulations. These signs, of which we illustrate one example, are supplied complete with chains and ceiling plates, and are provided with an adjustable rod at the back. Different



MOTOR-CAR INSPECTION LAMP.

types of reflectors may be attached to this rod in order to bring about any desired distribution of the light, upwards, downwards, and backwards. This design makes a great advance upon the older forms of solid box with mirror lining. The development of incandescent lighting with large units has led to a demand for special lanterns. Among the many designs included in the new catalogue is the inexpensive "Ordnance" lantern illustrated here for Osram "Atmos" type

lamps for workshops and other large spaces. A new form of the well-known "Highfield" lantern, fitted with a ventilated top and special wiring arrangements, is also included, and among others is the "County" lantern for Holophane glassware. A great variety of shop fittings and outside fittings suitable for docks, wharves, railways, and shipyards are also included. Sixteen types of hand lamps are mentioned in the catalogue. A special type illustrated here is a motor-car inspection lamp, built strongly of hard wood with a loaded base, for work where an upward light is needed. Sufficient examples have now been referred to to suggest the variety of fittings and fittings accessories listed, and those mentioned and illustrated will serve to indicate their thoroughly up-to-date character. Copies of this catalogue are available for engineers, contractors, and consultants on application to the General Electric Co., Ltd. (head office, 67 Queen Victoria Street, London, E.C.).

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Commonwealth Department of Defence (Navy Office) requires power station plant and equipment. Tenders to Naval Dockyard, Cockatoo Island, Sydney, N.S.W., by October 25th.

Barnes.—As the price of copper has a tendency to decline the Electricity Committee has decided, on the Engineer's advice, to defer the purchase of a small quantity of cable in the hope of a further decline.

Horsham.—Extensions to battery.

Shanghai.—One 5,000-kw. turbo-generator with condensing plant, and one or two 10,000-kw. turbo-generators with condensing plant. Consulting Engineers, Preece, Cardew, Snell & Rider, 8 Queen Anne's Gate, Westminster, S.W., September 24th.

Stretford.—H.T. mains are required by the Trafford Power & Light Supply Co.; also sub-station equipment.

Wiring

Bootle.—Weights and measures department at municipal offices. Borough Engineer, September 7th.

Dundee.—Extensions to post office. H.M. Office of Works, September 8th.

Kirkcaldy.—Lighting of new sanatorium. Borough Electrical Engineer, September 6th.

Manchester.—Improvement at New Theatre, Quay Street.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bury.—New out-patients' department at infirmary. Architect, C. R. Cooper, 20 Market Street.

Falmouth.—House in Cliff Road. Architect, A. J. Cornelius, Truro.

Mansfield.—New factory. Mansfield Shoe Co.

Paignton.—Extensions to isolation hospital (£3,000).

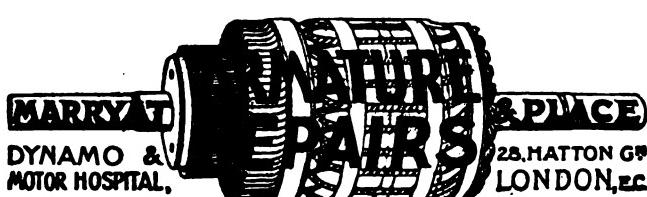
Shrewsbury.—Town hall and municipal offices.

Stretford.—Warehouse, Trafford Park Estates Co.

Miscellaneous

Australia.—The Sydney Harbour Trust Commissioners require six electrically-operated wharf capstans. Tenders to Commissioners, Circular Quay, Sydney, October 25th. Specification, &c., may be seen at 78 Basinghall Street, E.C.

New Zealand.—The Public Service Stores Tender Board,



Wellington, requires 92 miles of air-space, paper-insulated, lead-covered telephone cable, and 100 miles of insulated and braided wire.

Portsmouth.—Six months' supply of insulating materials, lamps, overhead line materials, motor windings, &c., for tramways department, August 31st. General Manager.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London: Great Central Railway Co.—A contract has been placed with Siemens Bros. Dynamo Works for a supply of Wotan lamps.

In reference to openings for British trade abroad, attention is called to the fact that reference must be had, in dealing with these, to the various proclamations relating to export at the present time. Firms intending to follow up any openings of this description should acquaint themselves with the export position as to the particular plant referred to.

APPOINTMENTS AND PERSONAL NOTES

Mr. A. E. Wilson, Deputy City Electrical Engineer, Bristol, has been appointed by the War Office Electrical Engineer to the Chief Engineer, Southern Command, and took up his new duties at Salisbury on Monday.

Dr. A. S. McAllister has resigned the editorship of the *Electrical World* (New York), which passes into the hands of Mr. F. M. Fieker, late editor of *Factory and System* (Chicago).

A switchboard attendant is required at Blackburn (see an advertisement on another page).

The South Wales Electrical Power Distribution Co. requires a meter tester (see an advertisement on another page).

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £76 10s. to £77 10s. (last week £79 10s. to £80 10s.).

Consulting Engineering.—The consulting practice of Robert Hammond & Son will be carried on under the same style notwithstanding the death of Mr. Robert Hammond, but pending the return of Capt. R. W. Hammond from the Front, work now in hand and any future work entrusted to the firm will be dealt with by Messrs. Preece, Cardew, Snell & Rider.

Customs Changes.—It is announced that all apparatus used in connection with the generation and distribution of electrical energy will, in future, be admitted duty free into the Uganda Protectorate. This exemption, however, does not apply to lamps and fittings.

Change of Address.—The Automobile & Electrical Equipment Co., of 2 Kingly Street, Regent Street, W., beg to announce that their offices and showroom have been transferred to more commodious premises, Grafton House, Golden Square, Regent Street, W., with works and garage situated in Bridle Lane, Golden Square, W. (Telephone : Gerrard 1701).

The I.M.E.A. Convention.—The Proceedings of the 1915 Convention of the Incorporated Municipal Electrical Association has now been published. They contain full reports of all the discussions, together with the detailed replies of those authors who were unable at the meeting, owing to shortness of time, to more than refer briefly to a few of the points raised. The Proceedings also contains the list of members.

LOCAL NOTES

Belfast: Fire at Electricity Works.—According to daily paper accounts there has been a fire at the Corporation Electricity Works, due to an accumulation of gas over the coal bunkers, resulting in several thousand pounds worth of damage being done. We understand, however, that neither the tramway service nor the general supply to the city was interfered with.

Dartford: Increased Electricity Charges.—The proposal of the Electric Lighting & Tramways Committee to increase the charge for ordinary house lighting by 1d. per unit, long-hour users by 1d. per unit, and power users by 1d. per unit, was the subject of some discussion at the last Council meeting. The criticism was to the effect that lighting consumers are being charged a larger increase in order to pay for the power users, but it was explained that the figures of increase actually represent 20 per cent. on each class. It was pointed out to the Council that the Electricity Committee felt bound to treat the subject as a business proposition. Current is costing more, and it must either be sold at a higher price or the loss put upon the rates. The Electrical Engineer estimates that the increases will produce £625 extra revenue per annum on the lighting, £104 on the long-hour users, and £416 on the power users. The Electricity Committee's proposal was eventually carried.

King's Lynn: Electricity Accounts.—The gross profit on the electricity undertaking last year was £4,226, and, after meeting interest and capital charges, there is a net profit of £1,350.

South Shields: Hiring Out Motors, &c.—The Corporation recently obtained powers to hire out electrical apparatus, and Mr. H. S. Ellis, the Borough Electrical Engineer, in his annual report, states that good progress is being made in putting these clauses into practical effect. He hopes shortly to be in a position to hire out motors, heaters, and cookers for a nominal annual charge. There was a net surplus on last year's working of £3,216, compared with £3,484 in the previous twelve months. The sum of £1,600 has been contributed to relief of rates and the balance carried to reserve fund, which now stands at £16,335.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Victoria Falls & Transvaal Power Co.—Mr. A. E. Hadley, the Managing Director, presided at the annual meeting on Friday, when the report and accounts given in our issue for August 12th were adopted. The Chairman's speech was largely concerned with an explanation of the accounts and the general financial position of the company. Since the issue of the report the whole of the extensions of 33,500 h.p. at the Brakpan Power House have been put into commission, and the total equipment of this station will enable the company to meet any abnormal increase in the business, which, it is satisfactory to note, still continues steadily, without encroaching upon the specified reserve plant. A tribute was paid to the hard work carried out by the much-depleted staff owing to the war. The Chairman (the Marquis of Winchester) and the General Manager in South Africa (Major the Hon. W. L. Bagot) are both serving, in addition to a considerable number of the staff. After the commencement of the war Herr Rathenau (whose death we recently announced) resigned from the board.

NEW COMPANIES

FULLER'S WIRE & CABLE CO., Woodland Works, Wick Lane, Old Ford Road, Bow, E. Capital £25,000. Manufacturers of telegraph, telephone, and electric supply cables, wires, &c.

ELECTRIC SAFETY HOISTS, 17 Water Street, Liverpool. Capital £500. To take over the Star Electrical Co.'s business carried on at the above address by A. H. Colley.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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Other Advertisement Rates on Application.

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Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

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Telegrams: "Circling, Fleet, London." Telephone No.: 5509 Holborn

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

A PAPER by Dr. Thornton recently read in the North of England describes the use of a shunt resistance to prevent danger from sparking from mining bells (p. 362).

THE report of the Inspector of Mines for the Yorkshire district gives data of the horse-power of motors, the number of coal-cutters, and electric safety-lamps in use, and the accidents due to electricity which have occurred (p. 362).

NEW designs of flame-proof telephones and bells for mines are described and illustrated (p. 363).

SEVERAL patent specifications relating to electric miners' lamps and gas detectors have been published during the past month. Others of interest to mining electrical engineers deal with electric winder control, and signalling. There are also three specifications relating to electric furnaces (p. 364).

THE starting-up of an induction motor by direct connection to an alternator without the intervention of switchgear is discussed in our Questions and Answers columns (p. 365).

AMONG the subjects for specifications published at the Patent Office last Thursday were slip-rings, gyrostatic compasses, incandescent lamps, and writing telegraphs. Two methods of rendering tungsten ductile are also described, and a German firm has a specification for a form of searchlight specially designed for following aircraft (p. 366).

IN connection with the manufacture of munitions in London, the metropolitan police area has been divided into ten districts. The general manager is the late General Manager of the Central London Railway, whilst the district managers are for the most part electric supply station engineers (p. 366).

A NEW double-pole tumbler switch is described on p. 367.

EXTENSIONS are contemplated at St. Helens (£15,000); an electric lighting scheme is under consideration at Armagh; an electric lighting plant is required at Haslingden; meters at Johannesburg; and a large quantity of telephone parts in Australia (p. 368).

WE give a few further particulars of the fire in the coal bunkers at the Belfast electricity works.—Some figures are given of the reduced cost of street lighting in various towns owing to the war.—There was a net profit of £4,304 on the Halifax electricity undertaking last year (p. 368).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING SEPTEMBER 11TH, 1915, by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday, 6.30 to 7.30 and 7.30 to 8.30.—Section 3, technical instruction; Section 1, musketry at the miniature ranges; Sections 2 and 4, squad drill.

Friday, 6.30 to 7.30 and 7.30 to 8.30.—Section 4, technical instruction; Section 2, musketry at the miniature ranges; Sections 1 and 3, squad drill.

Signalling.—It is proposed to form a signalling class, and the names of those wishing to join should be given at once to the Section Commanders.

Good progress is being made with the Training Corps, both in drill and in the technical work for which the Corps is specially preparing itself.

Arrangements have been made for the use of a Rifle Range, and members can attend, not only at the hours of drill, but at any time convenient to themselves for practice, instructors being in attendance and rifles provided.

There are still vacancies for recruits either among those attached to the Engineering Institutions or others to whom the technical work of the Corps appeals.

Applications should be made to Lt.-Col. C. B. Clay, V.D., the Commandant of the Corps, at Marconi House, Strand, W.C.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

THE session of the Royal Technical College, Glasgow, will commence on Sept. 28th, for day classes, and on Sept. 23rd for evening classes. The diploma course in electrical engineering extends over either three or four sessions. Special courses are provided in wireless telegraphy. The college is affiliated to the University of Glasgow. Particulars can be obtained from the Director.

The Session of the Faculty of Engineering at University College (Gower Street), London, begins on Oct. 4th. Intending students should communicate with the Provost not later than Sept. 15th. Full particulars can be obtained from Dr. W. W. Seton, secretary.

The courses in Electrical Engineering at Armstrong College, Newcastle-on-Tyne, which is affiliated to the University of Durham, will recommence on Sept. 27th. Special instruction in Mining Electrical Engineering can be taken. Full particulars can be obtained from Mr. F. H. Pruen, secretary.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

PREVENTION OF SPARKING IN MINING BELLS

A PAPER by Prof. W. M. Thornton was read recently before the North of England Institute of Mining and Mechanical Engineers on the precautions to be taken to prevent possibility of the sparking produced by the ordinary trembler bell causing ignition of gas, a subject which has been investigated by Dr. R. V. Wheeler for the Home Office (see ELECTRICAL ENGINEERING, May 6th, p. 197). Dr. Thornton discussed by the aid of oscillograms the growth of current in the inductive circuit after the "make" and the sudden high voltage produced at the break. The voltage, he continued, which causes the spark at the trembler-contact is produced by the rush of magnetism out of the coils when the current is broken. At the moment of break the battery voltage is all absorbed in the resistance, and does not affect the initial value. After the spark has ceased, the voltage across the gap is that of the battery alone. In good bells the time of break is found to be about half that of make, and the maximum voltage is about ten times that of the battery. The sparking at the trembler-contact is a series of ordinary break-sparks of short duration, in which both current and voltage are greatest at the instant of break. The igniting power of a break-spark depends on the voltage. It has been shown that the product of the least ignition current with the voltage is roughly constant. When the voltage is high, a small current becomes dangerous, and the degree of danger increases with the inductance in the circuit. With single continuous-current break-sparks on a 20 volt battery circuit, 0·5 henry causes ignition of the most inflammable mixtures of illuminating gas with a current of 0·5 ampere. Another factor of importance is the duration of the spark. It is sometimes as low as a fiftieth of the period, so that in a bell ringing twenty times a second the time of high voltage is a thousandth of a second. So short a duration is less favourable to ignition than an ordinary non-inductive break-spark, and this may account to some extent for the rarity of accidents in coal mines which might have arisen from bells. The ease of ignition of a given mixture by break-sparks as measured by the product Li (self-induction L and current i) is approximately constant. So long as the power of the bell spark does not reach the critical value the bell is safe. It is advisable to make the product Li as small as possible, for the rate of break depends to a great extent on the mechanical design and setting of the bell. It may be taken that signalling currents range on an average between 0·1 and 0·5 ampere, and the value of Li from 0·05 to 0·1. The sparking depends upon the working resistance in the circuit. The greater the resistance, the greater is the drop of voltage in the wires for a given current, and the less of it there is for the gap while the current lasts. The resistance of the spark is not independent of the current in the circuit, but it is clear that the greater is the resistance of the circuit the smaller is the sparking voltage for a given size of spark. Resistance in the battery or line, or bell-windings, therefore, diminishes the igniting power of the spark. Wet Leclanché cells having a higher resistance than dry cells are advantageous from this point of view.

For the purpose of preventing ignition of gas by a signalling bell, the first suggestion is to bridge the spark-gap by a resistance, but this may be in practice a positive danger, for by it a large part of the energy of the spark at the trembler is handed on to the signalling point on the wires. When, however, a suitable resistance is placed across the terminals of the coils, and the gap left unbridged, a break there gives rise to a spark of much less magnitude. The resistance may be always connected, or it may be so arranged that it is joined up by the movement of the armature just before break so avoiding the small current which passes continually while the bell is ringing. The resistance found to give the best results in practice varies from 20 to 150 ohms, depending on the design of the bell. This resistance provides a path for the "extra current" at break. In other words, the voltage at the spark-gap stops at the moment when it begins, for the current and magnetism in the coils die down slowly instead of being broken suddenly. The effect of the suppression of the sparking voltage is very marked. It is possible to work any bell

in full ringing in the most inflammable mixture of illuminating-gas and air without igniting the mixture while the shunt path is connected. Ignition occurs the moment that it is disconnected. By having a scraping contact in the testing chamber, it can be shown that the same increase of safety is obtained on the signalling wires as at the trembler-contact.

ELECTRICITY IN MINES York and North Midland District

THE report for 1914 of Mr. T. H. Mottram, H.M. Inspector of Mines for the York and North Midland Division, contains several references to electrical working.

The number of electrical coal-cutters in use in the district is given as 350 (including 157 disc, 87 bar, 104 chain, and 2 rotary heading machines). This is an increase of 19 over the figure for last year, and compares with 375 compressed air machines. The aggregate horse-power of motors in the 240 electrically equipped coal mines in the district is 123,648, of which 65,858 is on the surface and 57,790 underground. Of the latter, 28,699 h.p. is accounted for by haulage and 16,367 by pumping. Ventilation utilises 10,292 h.p., and winding 1,462. The motor h.p. in the five electrically equipped metalliferous mines in the district is 77 underground and 148 on the surface. A return is also given of the electric safety lamp employed, which number 88,085, made up as follows:—Bristol, 27; C.E.A.G., 24,626; Gray-Sussmann, 3,527; Joel-Fors, 453; Oldham, 6,223; and Wolf, 3,179.

The electrical accidents reported include two fatal and four non-fatal underground, and two fatal and five non-fatal on the surface, each relating to one person.

One of the fatal surface accidents, a tipper working at the screens, sustained a shock by touching a bare place on a lighting cable forming part of a 110-volt lighting, fed from tappings of the low-tension side of an 11,000/500 volt transformer, so connected that it was possible for the lighting circuit to have a potential of 500 volts above earth, as there was an earth on a part of the true 500-volt circuit.

In another case a greaser working at a bye-product coke oven stamp had attempted to switch off the current, and with one hand still on the switch touched the bare overhead wire with the other, receiving a fatal shock. Examination of the switch showed that it had become faulty in that it did not cause the blades to leave the contacts when the handle was put over.

The third fatal case was that of a coal cutter machine charge-man who, while fitting a rail to a sleeper in front of the machine received a shock from a trailing cable which was afterwards proved to be faulty, and to have the earth wire broken in two places. In reporting on this case Mr. R. Nelson, H.M. Electrical Inspector of Mines, expressed the opinion that earth conductors of trailing cables should be tested for continuity on each day before the cable is put into use. The agent of the colliery in this case was prosecuted for infringement of the regulations by having an earth conductor smaller than the minimum specified, but the prosecution failed owing to the cable having been in use before June 1st, 1911, although the coal-cutter itself had been installed since that date.

The last fatality occurred to an electrician who was splicing a cable to which current was switched on by someone who disregarded a notice that the switch was not to be touched. The management has since arranged to lock such switches while work is being carried out on the circuit.

Reference is also made in the report to the prosecutions arising out of the Wharncliffe Silkstone disaster (see ELECTRICAL ENGINEERING, Jan. 7th, p. 4). In one of the charges the manager and electrician were charged with not having an electrical cutter protected, worked, and maintained so that in the normal working thereof there was no risk of open sparking, contrary to General Regulation 132 (1).

After the explosion the coal-cutter was found not to be flame-tight, the joint between the commutator box cover and the body of the machine being so defective that a gap existed which had been caused by hammering a half-moon piece into position. In addition to this several bolts to hold the cover in position were missing. The defence was that the machine was perfect

when sent down the pit about a month before the accident, that the man in charge of the machine who was killed by the explosion ought to have put back the bolts, and that the indentation on the half-moon piece of the iron cover might have been caused by the removal of the armature on one occasion only, and was therefore of recent date. The Bench found that no criminal offence had been proved, and dismissed the charges.

There was also a prosecution of a haulage engine driver for interfering and tampering with electrical apparatus, when a fine of 10s., with £1 2s. 6d. costs, was inflicted.

FLAME PROOF TELEPHONES AND BELLS

FOR use in "fiery" mines, specially designed telephone instruments are necessary on account of the liability of inflammable mine gas being exploded should any sparking occur. The idea at first was to make the case of the instrument gas- and water-tight by employing packing between the joints, but this has not been found altogether satisfactory for the following reasons:—If the packing becomes defective (and it is difficult to maintain a perfect gas-tight joint), inflammable gas may diffuse into the instrument case and by means of a spark ignite, causing an explosion; as a result of this a part of the packing may be blown out or else the case shattered. In either event the flame reaches the outside gas, and an explosion may be brought about. Experiments have emphasised the fact that the products of an internal explosion cannot start an external explosion if they are below a certain critical temperature, so that if when an internal explosion occurs provision is made for the escape of the gaseous products in such a manner that they are effectively cooled, the problem is solved. The General Electric Co., Ltd., has given the best of its attention to such problems, and after a long period of most rigorous testing in actual practice has put on the market a flame-proof and water-tight telephone known as the G.E.C. Magneto Mining Telephone K8098 (1915

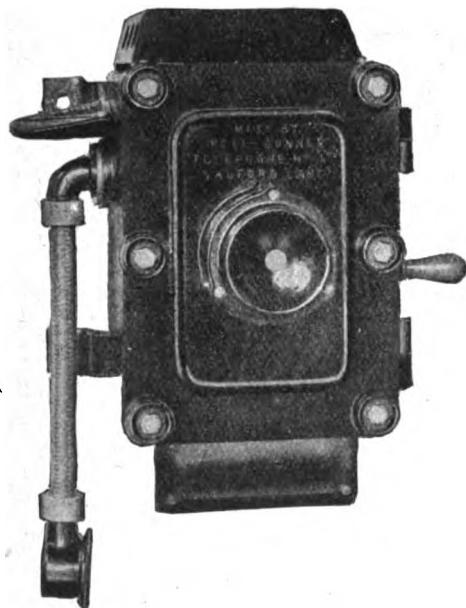


FIG. 1.—MINING TELEPHONE CLOSED.

type). This instrument is very strong and well finished. The case is of cast-iron, the joint between the case and the lid being made by machined flanges one inch wide. When the lid is bolted to the case, the joint is both water-tight and flame proof, i.e., any escaping hot gases are so thoroughly cooled in passing between the flanges that they cannot possibly ignite an explosive mixture outside the case even in the unlikely event of an internal explosion. The entire equipment is of the very highest standard, and is manufactured by the Peel-Conner Telephone Works, Ltd., of Salford, England. The internal unoccupied space is kept down to a minimum so as to limit the amount of explosive gas which might accumulate.

The equipment comprises a four-magnet tropical type generator with the armature wound to a resistance of 300 ohms, and fitted with a very strong handle working through a flame-proof and water-tight gland; a polarised bell movement wound with enamelled insulated copper wire to a resistance of 1,800 ohms and fitted with two 3-in. bell gongs, protected by an iron cover; long-distance speaking solid back transmitter

fitted in an iron chamber on the front of the lid, the diaphragm of which is protected from wilful damage by a fine-meshed brass gauze; induction coil wound with enamelled insulated copper wire, resistance of primary circuit 1 ohm, secondary circuit 25 ohms; a double-pole "bell" receiver wound to a resistance of 120 ohms is fitted inside the instrument, the diaphragm end being fitted with a cam arranged so as to revolve when the listening tube (which is placed on the left-hand side of the instrument) is lifted to the ear. The cam

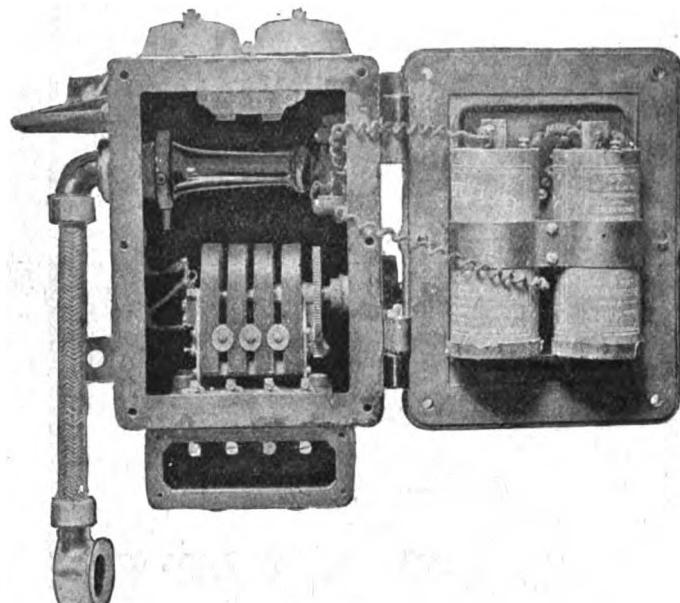


FIG. 2.—MINING TELEPHONE OPEN.

is fixed on to the receiver and revolves with it, thereby pressing together a bank of springs which control the primary and secondary circuits. The gland through which the tube passes is flame-proof and water-tight. Two No. 2 G.E.C. dry cells are fitted on the inside of the lid by means of a metal band. Attached to the bottom of the cast-iron case is a chamber which contains strong and well-designed line terminals. Four lugs fitted on the inside and back of the instrument are provided for fixing. All mining requirements are met in the best

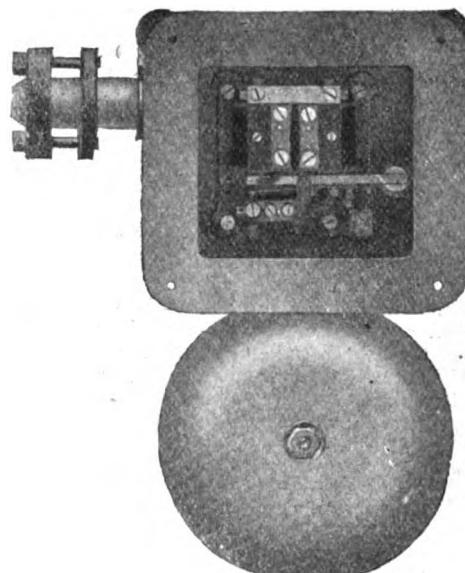


FIG. 3.—FLAME-PROOF AND WATER-TIGHT MINING BELL WITH COVER REMOVED.

possible manner, and all Home Office Regulations are complied with.

The same principles of protection are employed in the new G.E.C. flame-proof and water-tight trembling bell, illustrated in Fig. 3, which complied thoroughly with the Home Office regulations. The action is enclosed in a cast-iron flame-proof case. The lid is bolted to the case by a sufficient number of substantial bolts, and contact is made between machined flanges one inch wide. The case is water-

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tight and thoroughly enamelled to prevent rusting, and the internal unoccupied space is kept down to a minimum so as to limit the amount of explosive gas which might accumulate. The hammer is connected to the armature by a shaft which passes through a gland, one inch long, in the bottom of the case. It is situated under the gong and is thereby afforded additional protection. A flame-proof gland is also fitted to the case. It is designed to take an armoured lead-covered twin cable. The bell is made with two sizes of gong, 6 in. and 8 in. respectively. The 6-in. bell weighs 14 lbs. and requires a pressure of six volts across its terminals to work it satisfactorily, while the 8-in. bell weighs 16 lbs., and requires 10 volts. The resistance in each case is 25 ohms and the current taken just under 0.1 ampere.

For further information concerning these mining telephones and bells, as well as relays, complete mine signalling systems, &c., application should be made to the manufacturers, the General Electric Co., Ltd., at the head office, 67 Queen Victoria Street, London, E.C., or at one of their provincial branches.

**ELECTRICAL MINING AND METALLURGICAL
PATENTS OF AUGUST**

Mining.

A SYSTEM of control of electric winders and electrically-driven rolling mills, where a flywheel motor-generator is used, is described by S. H. Eckmann in Specification No. 17,037 of 1914. The chief feature is that the excitation and speed of the motor-generator set is controlled automatically according to the current taken by the motor of the motor-generator.

An electric miners' lamp embodying a gas-detecting apparatus is described by W. Kraushaar in Specification No. 194 of 1914. The firedamp indicator consists of a catalytic wire with a high positive or negative temperature-resistance

coefficient, connected in series with the lamp, the luminous intensity of which is varied by the alteration of resistance of the catalytic wire when heated by the action upon it of inflammable gas.

Another specification emanating from Germany connected with miners' electric safety lamps is No. 10,674 of 1914 of W. Rossow. This inventor surrounds the lamp bulb with a double-walled glass jacket containing either rarefied or compressed gas, and connected with a device that opens a circuit-breaker as soon as the pressure of gas within the jacket is altered by breakage of the external wall, so that the lamp is immediately extinguished. The outer double glass is easily detached when required.

A signalling system for haulage roads is described by the Sterling Telephone & Electric Co. in Specification No. 4,228 of 1914, which has been communicated from Germany by the Telephon-Fabrik A.G. Vorm. J. Berliner. Insulated conductors are used, a pair of which run along the whole track and are connected at intervals to enclosed contact boxes. The contacts are actuated by cords running from each box along the track to a point half-way to the next box.

A form of combined miners' lamp and gas detector is described by G. J. Ralph in Specification No. 10,100 of 1914. The detector is of the same kind as that already patented by the same inventor, depending on the change in resistance of a previously heated catalytic wire when exposed to inflammable gas. The actual indicator, in the form of a small galvanometer, is mounted on the top of the lamp, and is arranged to give a clear indication as soon as a proportion of 2 to 2½ per cent. of gas is reached.

In 22,227 of 1914, A. H. Railing and A. E. Angold describe a reflector for miners' lamps made of springy material which can be slid in between the pillars and glass of the lamp to direct the light in any desired direction, and when not in use can be clipped on to the body of the lamp.

Electro-metallurgical.

Specification No. 742 of 1914, of F. Krupp A.G. describes arrangements in an A.C. electrode furnace for automatically mixing up the charge. The mixing movement is imparted to the molten charge by the co-operation of the heating current supplied by the electrodes and spreading out in the charge in a radial direction, and a magnetic field directed at right angles to the upper surface of the bath. Several arrangements of connections are described.

Two specifications in the name of W. E. Evans (communicated from Germany by the Elektrochemische Werke Ges.), numbered 17,425 and 17,426 of 1914, deal with electric furnaces. The first is for a special form of furnace electrode constructed to minimise heat losses and of bell or cage shape, with walls of such a thickness that at any level the cross-sections are equal. It is provided with a hollow reinforcing ring, adapted to be cooled. The cross-section is calculated so that the C_2R effect causes the end of the electrode to attain the same temperature as the molten bath. The second specification describes a method of producing a flow or circulation in the molten charge in a furnace, characterised by the fact that the conductors that are employed are disposed at right angles to one another. At least two of these are channels filled by the molten mass in the furnace, and form a closed loop or path so that the liquid is set in motion by the electromagnetic interactions.

Electrical Mining Fatality.—At the Bardykes Colliery, Cambuslang, on Aug. 17th, a man named McDougal was killed by electric shock by coming in contact with a faulty cable.

Live Rail Fatality.—A boy of seven was killed by electric shock on the North-Eastern Railway at St. Peter's, near Newcastle, last week. It appeared from the evidence at the inquest that with another boy he had climbed a wall and was trespassing on the railway when he came in contact with the live conductor rail, and fell with his face on the rail. A verdict of accidental death was returned.

Electric Power from Niagara Gorge.—According to the *Electrical World* a scheme has been submitted to the New York State authorities to construct a 90 ft. dam across the Niagara Gorge, so that the present whirlpool rapids would be replaced by a fall at the lower end of the gorge from which about 2,000,000 h.p. would be available, half for New York State and half for Ontario.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,458.

I am attending to a continuous-current electric crane designed to lift 30 tons. The figures on the name-plate of the hoisting

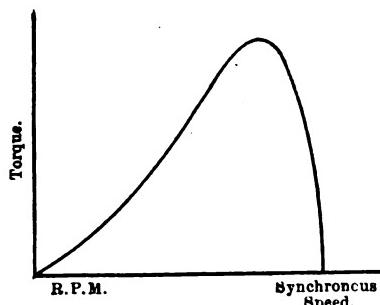


FIG. 1.
TORQUE DURING THE STARTING PERIOD OF A THREE-PHASE, SQUIRREL-CAGE INDUCTION MOTOR STARTING LIGHT.

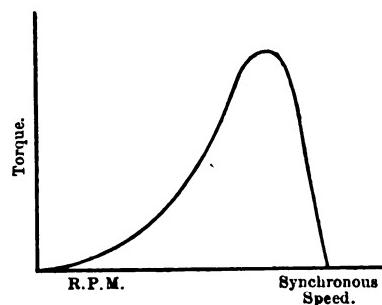


FIG. 2.

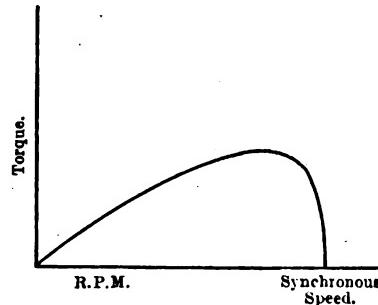


FIG. 3.

motor (which is series wound for 400 volts) are worn off. I should be glad to know what its rated horse-power and its normal and overload current is likely to be.—(H. T.)

[A lifting speed agreeing with usual practice may be assumed.—ED., E.E.]

(Replies must be received not later than first post, Thursday, September 9th.)

ANSWERS TO No. 1,458.

I wish to start up a 3-phase S.C. induction motor direct from an existing alternator without switchgear between the machines. Under these conditions, how will the torque of the motor vary with the speed? Is it necessary to separately excite the alternator field during the starting period? Are there any disadvantages in the method of starting?—M. M."

The first award (10s.) is given to "W. H." for the following reply:—

There is hardly sufficient information in the question to give a definite reply to all the queries raised. However, it is quite possible to start up a motor from an alternator without any switchgear.

(A) If the induction motor is a small machine, it would be possible to start up by simply connecting the cables to the line (assuming the voltage allows handling with gloves), and in this case the torque would rise to a maximum with increasing speed up to some point below the actual running speed, and would then rapidly fall again until the machine falls into step. That is assuming the motor starts light. The position of maximum torque relative to the speed depends upon the resistance of the rotor, viz., the higher the resistance the further away from synchronism is the maximum torque position (see Fig. 1).

(B) If, however, the motor is of any considerable size it becomes necessary to adopt other methods. The machine will require to be connected to the alternator while the line is dead.

If the induction motor has a large number of poles and is not therefore so subject to locking, it may be started up by simply bringing the alternator slowly up to speed, allowing the exciter (if direct coupled or driven from the alternator shaft) to gradually build up its own field. A very heavy current will be taken from the line and the starting torque will be very small as compared with the full load torque (Fig. 2). The torque during the starting period will vary as the square of the applied voltage and inversely as the cycles, so that the actual torque developed depends very largely on local conditions such as the time taken for starting up, &c. If the torque developed is not sufficient to start up the motor until the alternator is nearly up to speed, the flow of current into the motor may reach a dangerous value and may burn out the machine.

(C) To overcome this it will be necessary to separately excite the alternator field with its normal current and then gradually bring the alternator up to speed; by this means the voltage at the generator terminals will be much higher than before at lower speeds and the starting torque therefore much higher. With careful starting the alternator and motor may be kept practically in synchronism until right up to speed, and thus limit the current during starting to a reasonable value, even as low as full-load current. In this case the torque curve will be much flatter than before and will, of course have a higher value at starting. The disadvantage of this method of starting is, of course, the high current required to start the motor.

In method (A) the current may be five or six times full load current. In method (B) it may be three or four times, depending on the size of the motor. Method (C), of course, has the great disadvantage of requiring a separate source of direct-current supply.

The second award (5s.) is made to "E. H." who writes as follows:—

It is presumed that the induction motor in question is the only machine that is being supplied by the existing alternator, otherwise one of the standard methods of starting S.C. motors must be employed. Since no switchgear is to be introduced between the two machines, the voltage across the terminals

of the motor must be reduced at starting in order to limit the current. The extent of this reduction will depend upon the size and design of the motor. For machines of less than, say, 25 b.h.p. about half the normal voltage is quite safe; for larger machines the reduction should be more. With the alternator running at its correct speed this reduction in voltage is quite easily accomplished by resistances in the field circuits of the exciter and of the alternator, so that there is no necessity for separate excitation. It is advisable, however, not to decrease the exciter voltage too much, otherwise it becomes unstable. The chief disadvantage of this method of starting up an induction motor is that on account of the large voltage variation necessary, the alternator cannot be used for supplying any other load. Also the resistance in the alternator field has to be greater than would normally be required.

As regards the variation of torque with speed, this relationship is rather complicated, since it depends upon a number of factors. Thus the torque exerted by an induction motor is proportional to the rotor current \times flux in air-gap $\times \cos \phi$, where ϕ is the angle of lag of the currents behind the e.m.f.'s of the rotor, and is given by $\cos \phi = \frac{R}{\sqrt{R^2 + (2\pi f L)^2}}$, where R is the rotor resistance and L the rotor inductance per phase and f = frequency of e.m.f.'s induced in rotor.

The flux in the air-gap is practically proportional to the stator terminal voltage, whilst the rotor current depends upon the load against which the motor has to start up, and upon the rate of acceleration. As regards $\cos \phi$, this quantity is small at starting, since the rotor frequency is then the same as that of the supply, $2\pi f / L$, being consequently large in comparison with the resistance of a S.C. rotor. As the motor speeds up, the rotor frequency decreases, until at full speed, $2\pi f / L$ is very small in comparison with R , and $\cos \phi$ is almost unity. It should now be evident that if the alternator voltage be varied in such a way as to maintain a constant current during the starting period, the torque exerted increases rapidly with the speed.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published August 26th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

12,814/14. Slip Rings. SIEMENS-SCHUCKERTWERKE. Slip rings for high-speed machines carrying heavy currents formed of metal strip placed on edge and wound into coils, with means for preventing radial displacement of the ends. (One figure.)

12,959/14. Gyrostatic Compasses. ANSCHUTZ & Co. The gyrostats are run in enclosed chambers containing a gas lighter than air to diminish windage loss without sacrificing the possibility of getting rid of heat by convection, as when a vacuum is used.

13,541/14. Incandescent Lamps. C. GLADITZ. A glower for incandescent lamps, consisting of a closely coiled tungsten wire coated with a paste of thorium and cerium oxides with a binder of sodium silicate in an inert gas. (Three figures.)

13,920/14. Searchlights. SIEMENS-SCHUCKERTWERKE. Searchlights particularly for following aircraft in which the barrel is arranged to rotate both on its vertical and horizontal axes, and the light aperture is situated in the normally upper part of the cylindrical wall of the barrel, and a plane inclined mirror, preferably of boro-silicate glass, is fixed in such a way as to face the ordinary curved reflector at the end of the barrel. (Six figures.)

14,378/14. Continuous-current Generation. SIEMENS BROS. DYN. WKS., LTD., and C. A. KOETTGEN. A system in which a turbine-driven asynchronous alternator has its stator windings connected to the slip rings of a rotary converter. During starting and bringing up to speed in step, an auxiliary low voltage source of continuous current is applied to the D.C. side of the converter.

14,381/14. Rendering Tungsten Ductile. C. TRENZEN. The powder is prevented from taking a crystalline form by treatment in a powdered state with alkaline nitrates with subsequent pressing and heating.

18,290/14. Writing Telegraphs. A. G. BLOXAM (*Telepantograph Ges.*) A telautograph or writing telegraph in which the position of the reproducing pen is controlled by the relative strength of currents in circuits in a moving coil system in a fixed magnetic field, and not by their absolute strength. (Three figures.)

18,566/14. Gas-filled Lamps. A. E. G. Metal filament lamps filled with a mixture of argon and a gas such as nitrogen indifferent chemically to the filament by which a less amount of blackening is obtained than with pure argon.

23,496/14. Rendering Tungsten Ductile. GLÜHFÄDENFABRIK AARAU A.G. A method of preparing non-crystalline tungsten, consisting in fusing the metal to a perfectly liquid state in a resistance furnace, and suddenly cooling with an air blast. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: MARKS (Aluminum Co. of America) [Composite conductor cables] 21,650/14; BURDON (Siemens-Schuckertwerke Ges.) [Insulators] 23,486/14; HELLMUND [Distribution] 2,432/15.

DYNAMOS, MOTORS AND TRANSFORMERS: BRITISH WESTINGHOUSE ELECT. AND MNF. CO. (Westinghouse Elec. & Mnf. Co., U.S.A. [A. C. Commutator motors] 8,672/15.

Electrometallurgy and Electrochemistry: FEENY (Fabrik Elektrischer Zünder) [Electroplating wire] 13,699/14; JOHNSON (Badische Anilin & Soda Fabrik) [Electrolytic production of alkali metals] 17,763/14.

Heating and Cooking: DEUTSCHE GASGLÜHLICHT A. G. (Auerges.) [Cooking apparatus] 7,964/15.

Ignition: CARPENTER [Gas-igniting apparatus] 18,504/14.

Incandescent Lamps: DEUTSCHE GASGLÜHLICHT A. G. (Auerges.) [Incandescent lamps] 19,729/14.

Switchgear, Fuses and Fittings: SIEMENS-SCHUCKERTWERKE Ges. [Protective gear] 16,860/14; ROCKSTROH [Control of printing machines, &c.] 17,602/14; SWYERS [Switches] 18,509/14; TUCKER & CRABTREE [Switches] 23,272/14; KLUIJTMANS [Fuses] 2,370/15.

Telephony and Telegraphy: DOOTSON [Mining telephones] 4,526/14; SIEMENS & HALSKA A. G. [Telephone installations in

which the subscribers' lines are grouped according to the frequency of the calls] 16,316/14; TELEPANTOGRAPH Ges. [Writing telegraphs] 17,755/14; GLEDALL [Telegraph testing switch] 20,556/14; NICHOLSON [Buzzers] 611/15; RAINES [Multiplex synchronising systems] 3,985/15.

Traction: COLLINS [Electrically controlled joints] 11,629/14 and [Electric railway systems] 11,630/14; BURDON (Siemens-Schuckertwerke) [Overhead conductors] 22,113/14.

Miscellaneous: SIEMENS-SCHUCKERTWERKE GES. [Electric winding and hauling machinery] 17,548/14; OLDHAM [Locking miners' lamps] 18,442/14; WILSON [Condensers] 19,506/14; DONATH [Discharging tubes] 20,374/14; GES. FÜR ELEKTRO-OSMOSE [Electrical separation of gelatine, &c.] 21,448/14; FINDLAY [Bullet localiser] 23,170/14.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Miscellaneous: R. BOSCH [Band resistance for use with pedal switches] 11,480/15.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

17,860/01. Primers. SIR W. G. ARMSTRONG, WHITWORTH & Co., and G. STUART. Details of construction of an electric primer for explosives.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: COMPAGNIE FRANÇAISE DE L'AMIANTS DU CAP. [Cable insulation] 8,991/05; PORZELLAN FABRIK KAHLA FILIALE HERMSDORF KLOSTERLAUSNITZ [Insulator with rain cap] 10,972/07.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. Co. (G. E. Co., U.S.A.) [Brush connections] 9,908/05.

Switchgear, Fuses and Fittings: A. H. MAYES and FERRANTI, LTD. [Motor starters] 10,719/07.

THE METROPOLITAN MUNITIONS COMMITTEE

SOME time ago it was announced that steps were being taken to organise the engineering facilities in London for the purpose of producing munitions of war. This task was entrusted to the Metropolitan Munitions Committee, and we learn that the organisation of that body is now practically complete, and that most excellent work is being done. A central office has been established at Alexandra House, Kingsway, with Mr. Cecil Partridge, late General Manager of the Central London Railway, as General Manager, and Mr. W. E. Ireland, Rolling Stock Superintendent to the L.C.C., as Chief Engineer. The jurisdiction of the Committee extends over the whole of the Metropolitan Police Area, which has been divided into ten districts, each under a District Manager, who is associated with an assistant and a Munitions Engineer. The following have been appointed District Managers:—

Northern.—A. Hugh Seabrook, Borough Electrical Engineer, Marylebone (acting) (62 Finsbury Pavement, E.C., temporary address).

North-Western.—E. T. Ruthven-Murray, North Metropolitan Electric Power Supply Co. (346 High Road, Kilburn, N.W.).

Southern.—A. C. Cramb, Borough Electrical Engineer, Croydon (Town Hall, Croydon).

South-Eastern.—W. G. Head (Borough Hall, Royal Hill, Greenwich, S.E.).

South-Western.—C. O. Grimshaw, Westminster Electric Supply Corporation (6 Eccleston Place, S.W.).

Eastern.—C. Newton Russell, Borough Electrical Engineer, Shoreditch (215-217 Bishopsgate, E.C.).

East Central and part South-Eastern.—E. Harlow, City of London Electric Lighting Co. (64 Bankside, S.E.).

Western.—R. S. Downe, Brompton & Kensington Electricity Supply Co. (Carnegie Library, Hammersmith, W.).

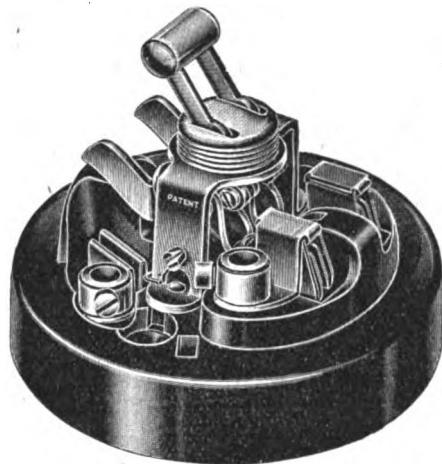
Poplar and Stepney.—G. M. Gill, Commercial Gas Co. (East London College, Mile End, E., temporary address).

Outer Eastern.—S. H. Wood, Gas Light & Coke Co. (Gas Works, Beckton).

Any information likely to be of use in connection with the production of munitions, and all inquiries, offers of premises, of tools, plant, or services, &c., should be directed to the General Manager, Metropolitan Munitions Committee, Alexandra House, Kingsway, or to one or other of the District Managers, according to the district.

SINGLE-TUMBLER DOUBLE-POLE SWITCHES

THE term single-tumbler double-pole switch is meant to convey that the article in question is a tumbler-action switch for double-pole connection. Thus instead of the usual coupling together of two separate single-way tumbler switches, we have the combination on one base of ordinary size. So far as we know, Messrs. A. P. Lundberg & Sons (477-489 Liverpool Road, London, N.) are the only manufacturers of switches of this kind; and their 10-amp. surface pattern is shown in the figure, the scale being two-thirds the actual size. A 5-amp. size is also made both for surface and



SINGLE-TUMBLER DOUBLE-POLE SWITCH.

flush work, and various patterns of cover (metal or porcelain) are available, the metal covers for surface work being generally lined inside with fibre. This type of switch is largely used on electric heating and cooking apparatus, in conjunction with some other type, for varying the number or arrangement of the heating sections in circuit. Some of these groupings are as follows:—Double-pole with series-parallel, double-pole with series-parallel and off, double-pole with "twinob," double-pole with "all-or-part," double-pole with special switch. Although the details of these controls are of especial interest to designers and makers of electric heating apparatus, who should write for the firm's special list "H," there are also uses to which these switches can be put in lighting installations. For example, when a lamp (or group of lamps) is on an out-of-doors circuit, or in a cellar or other more or less damp place, it is better to break the circuit on both poles than to use a single-way switch. The same arguments apply also to the control of plug-sockets, an additional one being that there is no chance of shock at all if the socket is entirely "dead" when off. It should be obvious that these compact forms of double-pole switch are also useful in laboratory, lecture, and testing work; and on various classes of practical apparatus in wide use.

SILK SHADES

THE season is fast approaching when the public will be looking to their lighting arrangements, more especially regarding lamps and shades. For some little while the Edison & Swan United Electric Light Co., Ltd. (Ponders End), have been doing a business in their silk shade department, but



this is the first opportunity we have had of calling special attention to this branch of the firm's manufactures. A neat little stiff-covered booklet of silks has been forwarded to us, which contains nearly fifty different tints of reds, greens, blues, browns, &c., with a large sample attached to enable a

prospective buyer to test the quality. All shades can be recovered in a similar fashion to match others, and old pattern shades can be renovated. The illustration here represents one of the many stock patterns, but it is also a speciality of this department to make for all individual requirements.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Armagh.—An electric lighting scheme is under consideration.

Haslingden.—The Co-operative Society propose to put down an electric lighting plant.

New Zealand.—An electric lighting scheme is to be put in hand at Bay Town, a suburb of Dunedin.

St. Helens.—An L.G.B. inquiry was held last week concerning a loan of £15,000 for new plant, &c. The Borough Electrical Engineer informed the Inspector that these extensions would have been necessary apart from the war, but the great demands of firms engaged upon munitions rendered them more necessary now. There was no opposition. The proposed extensions include a condenser (£9,985); switchgear (£515); cooling tower, pipework, &c. (£1,250); water-tube boiler and mechanical stokers (£1,750).

Wiring

Batley.—Electric lighting of Methodist Chapel. Tenders to W. Purdy, 59 Canary Islands, Batley Carr, Batley, by Sept. 6th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Birmingham.—Enlargement of East Telephone Exchange. H.M. Office of Works, Storey's Gate, London.

Briton Ferry.—Alterations and additions at Council School. Clerk, County Hall, Cardiff.

Chorley.—Extensions to Leyland Motors, Ltd., factory.

Jarrow.—New goods warehouse, &c., for North Eastern Railway Co. Architect, Arthur Pollard, Irving House, Westgate Road, Newcastle-on-Tyne.

Neath.—Joint Isolation Hospital. Architect, J. Cook Rees, Parade Chambers.

Miscellaneous

Australia.—The Deputy Postmaster-General, Melbourne, requires a large quantity of various telephone parts. Sept. 21st.—The Deputy Postmaster-General, Brisbane, requires 2,860 yds. of silk- and cotton-insulated switchboard cable. Oct. 6th.—The Deputy Postmaster-General, Adelaide, requires a portable direct-coupled internal combustion engine and dynamo. Oct. 6th. Copies of specifications, &c., may be consulted at 73 Basinghall Street, E.C.

London: Islington.—The Guardians require a six months' supply of electrical fittings and sundries. Clerk, St. John's Road, Upper Holloway. Sept. 9th.

South Africa.—The Johannesburg Council requires 1,595 meters and 50 time-switches. Copy of specification may be seen at 73 Basinghall Street, E.C. Sept. 25th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Coatbridge.—A contract has been placed with Messrs. Chamberlain & Hookham for a twelvemonths' supply of meters.

Coventry.—We mentioned a short time ago that the Electricity Committee had recommended a large scheme of extensions rendered necessary by demands from factories employed on Government contracts, on condition that certain guarantees were forthcoming from the Minister of Munitions which would safeguard the Corporation against loss on capital account in the event of a cessation of the additional demand for power. It is now stated that sufficient assurances have been given, and application is to be made for the necessary loan amounting to £80,088 10s. Meanwhile, provisional contracts

have been entered into with the British Thomson-Houston Co. for a 6,000-kw. turbo-alternator, and with Babcock & Wilcox, Ltd., for four boilers. To make room for this new set, two 800-kw. sets will be displaced.

APPOINTMENTS AND PERSONAL NOTES

We are pleased to record that the Managing Director of our contemporary, the *Electrical Times*, Mr. R. W. Hughman, has been promoted to a Captaincy in the 2nd Battalion of the 9th Middlesex (Territorial) Regiment. Captain Hughman joined the regiment as 2nd Lieutenant soon after the commencement of the war.

The Bradford Electricity Department requires switchboard attendants. Wages 40s. per week.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £84 to £85 (last week £76 10s. to £77 10s.).

Liquidation.—The adjourned meeting of creditors of Vanners Electrical Cooking & Heating Appliances, Ltd., will be held at Blomfield House, 85 London Wall, London, E.C., on Thursday, September 9th, 1915, at 12.30 p.m.

LOCAL NOTES

Aberdeen: *Reduced Street Lighting.*—The enormous reductions in street lighting due to the war have resulted in an annual saving of £5,352, apart from globes, carbons, &c.

Belfast: *Fire at Electricity Works.*—We are now able to give a little more information with regard to the rather serious fire which occurred at the electricity works on the 22nd inst., to which we briefly referred in our last issue. As we stated last week, the fire involved the part of the building immediately over the bunkers. This portion of the building was designed to avoid coal dust causing a nuisance in the adjoining street, and was, in consequence, poorly ventilated, and was constructed largely of wood. Heating in one of the bunkers liberated sufficient gas to fill this structure; the gas became ignited, and fired all the woodwork simultaneously. The damage is chiefly confined to this structure and the coal conveyor, which is partly destroyed. There was no interruption to the electricity supply whatever, the fire brigade effecting a splendid save of the adjoining buildings. The whole is covered by insurance, and the work of restoration will easily be completed before the winter's load.

Bridlington: *Electricity Works and Lighting Regulations.*—Councillor J. V. Mainprize, a former Chairman of the Electricity Committee, has been instrumental as a Special Constable in getting the Acting Borough Electrical Engineer fined for failing to obscure the roof lights at the electricity works.

Brighton: *Street Lighting Restrictions.*—The Electricity Committee has arranged to reduce the expenditure on street lighting during the coming year by a further £5,000, and this, added to the present reduced street lighting, involves a loss of revenue to the electricity undertaking to the extent of £9,000 per annum.

Glasgow: *Fire.*—There was a fire on the premises of the well-known Glasgow firm of electrical engineers and contractors, Messrs. M'Whirter & Son, on Friday, which resulted in some £1,500 damage to the stock.

Halifax: *Electricity Accounts.*—After meeting capital

charges, there was a nett profit of £13,036 on the working of the electricity undertaking for the year to March 31st, compared with £10,268 in the previous twelve months. Of this balance £4,041 is transferred to relief of rates, £2,500 is absorbed in a third instalment of the cost of the foundations for the 3,500-kw. turbo-alternator, and, after meeting the cost of a number of other items of a capital nature, there is a balance of £4,304 to be carried forward, compared with £585 in the previous year. The amount transferred to relief of rates is slightly in excess of that similarly transferred in 1913-14. The total number of units sold was 11,075,893, against 9,670,008 on March 31st, 1914.

London: *Stepney: Coal Delivery.*—Arrangements are being made for the acquisition of a sufficient river frontage to enable coaling steamers to be brought alongside the electricity works.

Salford: *New Tariff.*—The Electricity Committee has decided that electricity used for motors driving dynamos for the purpose of producing energy for lighting will be charged at lighting rates except in the case of motor-generators used for cinematographs, when the charge will be a flat rate of 2½d. per unit.

Yorkshire: Power Co. and Small Districts.—Apparently, as the result of the attitude of the Board of Trade during the progress of its Bill in Parliament last year, the Yorkshire Electric Power Co. is now approaching a number of the smaller districts in its area with a view to applying for electric lighting provisional orders. In the company's Bill last year it was proposed to take lighting powers *en bloc* for practically all districts in the company's area in which provisional orders had not been granted, but the Bill was rejected after evidence had been heard from the Board of Trade to the effect that objection was taken to this method of procedure, and that the right course was that the company or the local authorities should apply for separate electric lighting orders.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

South Metropolitan Electric Light and Power Co.—Dividends on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares are announced.

NEW COMPANIES

ANDOVER & DISTRICT ELECTRICITY CO., 26 Bridge Street, Andover. Capital £10,000. To take over from Messrs. Crompton & Co. the Andover Electric Lighting Order, 1915.

Installation Estimates.—We have received a copy of a Paper which was read some little while ago before a students' meeting of the Glasgow Local Section of the Institution of Electrical Engineers by Mr. N. C. Woodfin, which was entitled "Electrical Estimates and Opportunities." The author enlarged upon the trouble and expense that contractors are put to in preparing competitive estimates for installations sometimes of considerable complexity, especially when no specification by a consulting engineer is issued and the information given by the purchaser is of a meagre character. His remarks were aptly illustrated by an example worked out in detail of a power installation in a mill, for which his firm finally lost the order because a cheaper form of generating plant than they considered suitable was accepted. Other cases were quoted to show that the cost of estimating often swallowed up the slender margin of profit which was all that orders could be obtained on in these days of severe competition. He pointed out how the electrical industry was penalised by the system of free estimates, and urged that they should be paid for if firms with anything short of an enormous turnover were to make a living profit. His object in bringing the matter forward was to urge that the Institution of Electrical Engineers should take some action to better the state of affairs.

The Iron and Steel Institute.—The programme of the autumn meeting in London, Sept. 23rd and 24th (at the Institution of Civil Engineers, Great George Street, Westminster), has now been issued. Among the Papers down for reading is one by Prof. K. Honda and H. Takagi on the magnetic transformation of cementite.

Wireless Control of Torpedoes.—The *Electrical World* (New York) states that the United States Navy contemplates the building of special hydro-aeroplanes, fitted with wireless apparatus by which torpedoes in the water below can be steered and controlled.



ELECTRICAL ENGINEERING

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Letters for Insertion, *Tuesday first post.*

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Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

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SUMMARY

THE position of electrical manufacturers whose active munitions output places them in a position of having to neglect the manufacture of electrical plant is referred to in an article on p. 370.

THE meeting of the British Association at Manchester commenced on Tuesday with the reading of the Presidential Address, and the addresses of the presidents of the sections were given yesterday (p. 370).

MR. S. W. CUTTRISS gives a series of useful curves for determining the number, spacing, and size of incandescent lamps required to give any desired degree of illumination with different types of reflectors (p. 371).

THE appearance of patent specifications of German origin among those published every week at the Patent Office is explained (p. 372).

THE construction of small motors to run off either D.C. or A.C. circuits is discussed in our Questions and Answers columns (p. 372).

A CORRESPONDENT deals with the position of the electric lamp industry in Spain (p. 373).

SOME misunderstanding has arisen regarding the Arbitrator's award as to London wiremen's wages owing to a circular letter from the wiremen's union which was referred to in some of our contemporaries (p. 373).

A DESIGN of conduit continuity grip is illustrated (p. 373).

AMONG the subjects of specifications published by

the Patent Office last Thursday are: finding the position of ships at sea by combined acoustic and wireless signals, protective systems, cables, and telephonic bullet localisers. The A.E.G. patent for long-necked bulbs with baffle plates in half-watt lamps is also published. One or two amendments of electrical patents have been allowed, and B.T.-H. patents for circuit-breakers and train-control expire this week after a full life of fourteen years (p. 374).

EXTENSIONS are to be carried out at Bury (£7,225); the Amble Council proposes to adopt street electric lighting; the Johannesburg Council requires a large number of house-service cut-outs; electrically-driven letter-sealing machines are required in New Zealand; and stores are required in various places (p. 375).

THERE seems every prospect that the proposed linking-up scheme between Battersea, Fulham, and Hammersmith will now proceed without Hammersmith taking part in it.—The suggestion of Councillor Ross Clyne for the appointment of a Special Committee to inquire into the working and control of the Manchester Electricity Department met with no support when it came before the Corporation last week (p. 376).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING SEPTEMBER 18TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Monday: Section I., technical instruction. Section III., musketry at range. Sections II. and IV., squad drill or signalling.

Tuesday: Section II., technical instruction. Section IV., musketry at range. Sections I. and III., squad drill or signalling.

Classes for signalling instruction are being formed, and the names of those desiring to take part should be handed to the Section Commanders.

The Corps will still be glad to welcome recruits. Although primarily appealing to members of the engineering institutions, others whose tastes lie in the direction of a technical training will find this Corps meet their views.

Applications should be made to Lt.-Col. C. B. Clay, V.D., the Commandant of the Corps, at Marconi House, Strand, W.C.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

The Munitions Inventions Branch.—The Munitions Inventions Branch which, as we pointed out on page 350 of our issue for August 19th, has been constituted by the Minister of Munitions, has removed from Armament Buildings, Whitehall Place, S.W., to larger accommodation in Prince's Street, Storey's Gate, S.W. The panel of honorary scientific and other experts, whose names we have already given, is now at work in committees, and is already dealing with a large number of proposals.

OUR CHANGED ELECTRICAL INDUSTRY

A NYBODY who might have proclaimed, at the outbreak of the war thirteen months ago, that the majority of our large electrical manufacturers and a continuously increasing number of smaller ones would soon be chiefly engaged making non-electrical material would have been greeted with a smile of contemptuous incredulity. Yet such has been the case for a considerable number of months. For obvious reasons we can publish no quantitative information as to output of war munitions from electrical manufacturing works, but we are betraying no secrets in stating that in view of the necessity for rapid output, the manufacture of electrical machinery and apparatus has to take quite a secondary place in many large works, which, previously to the war, never contemplated making other things than electrical plant. Not only has the "business as usual" policy been absolutely abandoned—if, indeed, it ever came into effect—but the desirable attack on the world's markets to secure Germany's colossal export trade has necessarily to be deferred during the present time, until, at any rate, the need for ammunition is officially stated to be less great. That the time has not come for any diminution of the present rate of production of war material should be fairly obvious. The slow progress in the western theatre of the war, the abandonment of Warsaw and the hundreds of square miles of their own territory which the Russians have had to relinquish temporarily to the enemy, and finally the enormous expenditure of high explosive shells in the Dardanelles, all point in one direction: more rapid production of ammunition is necessary. It has become a habit to accuse the Government of reticence as to the true state of affairs, but in this thing there has been no reticence. More munitions have been called for from the works already manufacturing them; the output has been increased, and still more is needed. More workmen have been required; they have been forthcoming, and still more are needed. More factories have been wanted to manufacture munitions; hundreds have been converted to munition factories, and still more are needed. In this state of affairs, it is greatly to be regretted that, in some quarters, the suggestion has been made or hinted that the patriotic works who have neglected their normal electrical output to fulfil the country's urgent call should now consider whether they have done right, and the bait of increasing oversea trade is held up to them. It is but too true that trade will be lost, and that neutral countries will benefit in the meantime, but this cannot be otherwise. So far the electrical manufacturers as a whole have not been out of pocket by the war, but even if they had been, their duty to the country comes first.

THE BRITISH ASSOCIATION AT MANCHESTER

I N spite of the war the meeting of the British Association is being held at Manchester, although it is of strictly businesslike character and is shorn of the social features which have characterised previous gatherings. The shadow of the war, however, distinctly lies over the meeting, although necessarily not many of the papers to be read deal directly with war subjects, except in the Economic Science Section. The proceedings commenced on Tuesday night with the reading of Prof. A. Schuster's Presidential Address to the whole Association, on the common aims of Science and Humanity, containing a brave attempt to lift our thoughts for a moment from the gross materialism of war. The addresses of the presidents of the different sections followed yesterday, and to-day the reading and discussion of papers is in full swing.

Dr. H. S. Hele Shaw's presidential address to Section G (Engineering) was essentially a militant address, and emphasised the part played by men of science in modern warfare. He dealt particularly with the ways in which the Section can bear a share of the burden. He suggested that the three existing research committees should be continued, but a further special committee formed first to undertake any work which

might be of use in an advisory capacity or by research, or, indeed, in any other way for direct assistance in the war, and secondly to deal with the situation that will arise after the war in helping to make ready for the struggle that Germany is certain to put up in the arts and manufactures. In this latter connection he put forward statistical evidence of the rapid and increasing rate of increase of Germany's iron and steel industries during the past 50 years, which he compared with the slower rise of our own. The latter part of the address studied in some detail the causes of the greatness of this advance. It was, he said, in the matter of scientific organisation even more than the organisation of science that Germany had achieved such wonderful results, and it was in this direction that we must leave no stone unturned if we wished to have any chance of holding our own in the future. The fields to which he gave particular attention were technical education, where much had been commenced but much remained to be done, and research, which was another subject wherein a British Association committee might render great service. Another equally important field was standardisation, and in this connection he referred to the important work of the Engineering Standards Committee, and incidentally quoted a remark of the Secretary of the International Electrotechnical Commission to the effect that the want of uniformity in the rating and testing of electrical machinery had been a serious evil. The German standardisation rules, for instance, which, through well-organised and combined effort on the part of the German makers, had previous to the war become widely recognised on the Continent of Europe as well as in many countries to which British machinery is exported, by permitting a higher temperature rise than is considered good technical practice in Great Britain, certainly had not assisted the British maker in foreign markets. He also urged that such a committee that he was proposing could exert influence regarding the holding of exhibitions and the establishment of commercial museums and the reform of patent law. The most important work, however, was the organisation and co-ordination of industry, without which efficiency could not be obtained. The British Association was a powerful body, and would be listened to if such work was carefully and energetically done.

As regards the papers and reports, the interest of electrical engineers centres mainly around the Engineering Section, where Prof. Miles Walker will read practical papers on the eddy-current losses in the end plates of large turbo-generators and on commutation, and a theoretical paper on the possible existence of mutual induction between masses. The heating of iron by high frequency magnetisation will be dealt with by Mr. N. W. McLachlan, and Messrs. H. M. Lacey and C. H. Stubbings will also read a paper on transformer core losses as affected by triple harmonics. The wireless telegraph papers will include one by Dr. Eccles and Mr. A. J. Makower on oscillations in coupled circuits, two by Prof. G. W. O. Howe on the capacity of aerials, and a note on earth resistance by Prof. E. W. Marchant. The report of the Committee on Wireless Telegraph Research will, however, be submitted to Section A. Although not mentioned in the preliminary programme, there is a likelihood of an interesting discussion on municipal engineering (including electricity supply) being held at one of the meetings of Section G.

Enemy Shares in Electrical Co.—The Concordia Electric Wire Co., Ltd., which was registered in 1902 as an English branch of a firm of electrical cable and wire makers at Adlershof, near Berlin, was summoned at Bow Street Police Court last week through two of its directors, Robert Fifer and Leopold Aron, for not communicating to the Public Trustee full particulars of 13,993 shares in the company. According to counsel who prosecuted on behalf of the Director of Public Prosecutions, the original nominal capital of the company was £2,000 in £1 shares, all but seven of which were held by Aron on behalf of the German company. In November, 1913, a further 12,000 £1 shares were issued in a similar way. In May, 1915, it was stated, Aron, fearing internment, which has since happened, transferred the whole of the shares to two of the company's employees under an arrangement by which he would receive all the profits, but his name disappeared from the register of shareholders. No notice of this transaction was given to the Public Trustee. For the defendants it was stated that the omission was due to ignorance, and that no part of the profits of the company had been transmitted to Germany since the war began. The magistrate, however, took a serious view of the case, and fined the defendants in all £750 and 25 guineas costs.

Electric Commercial Vehicles.—Some trials of heavy electric vehicles conducted by the Zurich electric supply authorities resulted in a journey of 120 kw. (74·5 miles) in 6½ hours (*i.e.* an average of 11·5 m.p.h.), with a useful load of 1,500 kg. (1½ tons) over a rather hilly route with a total rise of 670 metres (220 ft.). The result is of particular interest to the Swiss on account of the serious shortage of petrol with which they are faced.

INSTALLATION CURVES FOR INCANDESCENT LAMPS AND SHADES

By S. W. Cuttriss

IN the early days of the electric light industry, when it was desired to lay out an installation of incandescent lamps, the contractor either proceeded by guesswork or adopted the rough approximation of one 16-c.p. lamp per 64 sq. ft. of floor area. If the resulting illumination was not equal to requirements, or if the lighting proved excessive, the lamps were changed for others of higher or lower candle-power as desired. Foot-candles, lumens, and such-like terms, more or less familiar to the modern engineer, were then unknown, and the possibility of calculating beforehand the intensity of illumination to be anticipated from a given lay-out was a proposition undreamt of. Neither did he trouble his head with considerations of the influence of reflection and diffusion from surrounding surfaces or the probable effect of different designs of shades on the distribution of the light.

Fortunately the study of scientific illumination has progressed side by side with improvements in the efficiency of

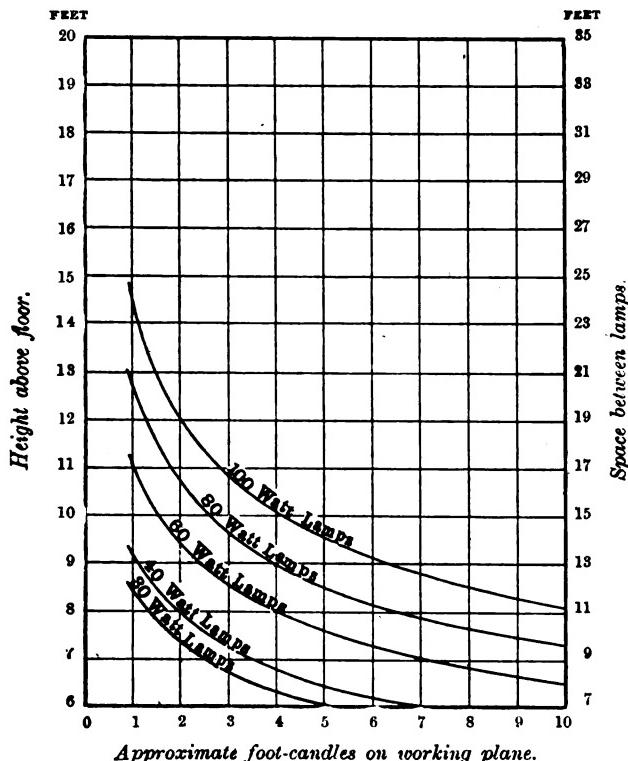


FIG. 1.—“EXTENSIVE” TYPE SHADES.
For use in small rooms, or large rooms with low ceilings.

the incandescent lamp, and one is now able to calculate with fair accuracy the requirements necessary to produce with economy any desired lighting effect or definite intensity of illumination; therefore if a little patience is exercised to make the necessary calculations, any installation can be figured on paper with reasonable confidence that the result will be satisfactory. Unfortunately, if due consideration is given to all the varying factors, the calculations become somewhat tedious and the keenness of competition discourages any attempt to devote the necessary time to a careful consideration of the work on scientific lines. After filling a few sheets of foolscap with figures involving many plus and minus factors the contractor is apt to get disgusted, throw the lot into the waste-paper basket, and trust as formerly to his empirical rules, if he has any. A sympathetic feeling for the difficulties of the position caused the writer to see if the numerous and conflicting data could not be boiled down and a series of curves obtained which would be sufficiently accurate for average conditions, and at the same time ensure a reasonable confidence in the illuminating effect resulting from their application.

The introduction of the metallic filament lamp necessitated the design of special types of reflectors for the double purpose of shielding the eyes from the highly incandescent filament and also for deflecting downwards the horizontal rays which form the major portion of the light radiated by the lamps.

Manufacturers have evolved several standard designs, varying in their power of concentrating the light in a contracted area underneath the lamps, according to the purpose for which

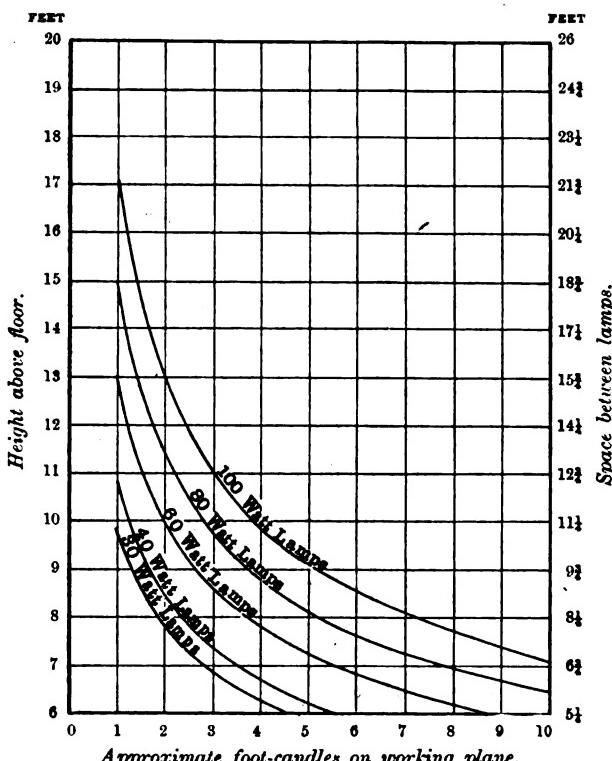


FIG. 2.—“INTENSIVE” TYPE SHADES.
For use in large rooms with average ceiling height, and small but lofty rooms.

they are required. Three types specially useful for general installation work are known as “extensive,” “intensive,” and “focussing” patterns, and they are designed to give a fairly even illumination on a horizontal plane under the

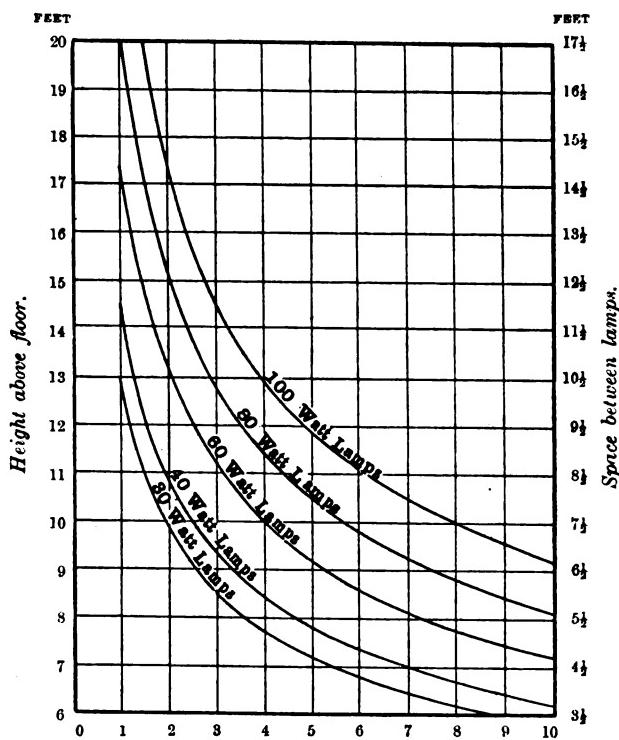


FIG. 3.—“FOCUSING” TYPE SHADES.
For use in large rooms with high ceilings.

lamps enclosed by angles from 45° to 15° from the normal. To obtain even illumination over an extended area it is necessary that the units be spaced apart a definite distance, relative to their height above the working plane, which

latter is generally accepted as $2\frac{1}{2}$ ft. above the floor. The spacing distances vary for each type of reflector.

Although many of the modern shades are very efficient in their reflective power, there is necessarily a certain loss of light due to absorption by the material of the reflector, and this has to be allowed for. Further, the reflection from the walls and ceiling of a room have to be taken into consideration, which latter may have a very appreciable effect on the resulting illumination on the horizontal plane.

The curves reproduced in Figs. 1, 2, and 3 have been calculated for average conditions in rooms with light-coloured walls and white ceilings, using the present standard lamps of from 30 to 100 watts, having an efficiency of 1.3 watts per c.p. (British). Although the curves are drawn for illumination on the working plane, the height of the lamps from the floor level is stated, which latter is the figure of practical use when installing. The foot-candle intensities are only approximations, and photometric tests might very possibly show somewhat different values, but this fact does not destroy the utility of the curves, which will be found to afford a ready means of comparing one type of reflector with another under varying conditions, without having to wade through tables and manufacturers' catalogues, and in the end probably wasting valuable time without any satisfactory result.

Comparing the "extensive" type curves, it will be seen that 30-watt lamps at a height of $8\frac{1}{2}$ ft. from the floor and spaced 12 ft. apart will give 1 f.c. on the working plane, while 100-watt lamps at $14\frac{1}{2}$ ft. and spaced 24 ft. will give the same illumination, or the latter lamps at $8\frac{1}{2}$ ft. and spaced 12 ft. will give 8 f.c. With focussing shades and 30-watt lamps $8\frac{1}{2}$ ft. high, it will be necessary to space them 6 ft. to obtain even illumination, and the intensity will then be 3 f.c. on the working plane, whilst 100-watt lamps at $14\frac{1}{2}$ ft. and spaced 12 ft. will also give 3 f.c. It is evident these curves will enable the contractor to choose readily, without elaborate calculations, the most suitable type of shade and lamps, and ascertain the height and spacing necessary to obtain any desired intensity of illumination on the working plane.

GERMAN PATENTS AND THE WAR

IT will have been noticed by readers of our Patent Record that the batch of specifications published by the Patent Office each week still contains a considerable number of German origin, some even dealing with war material. It is perhaps not generally realised, however, that the majority of these relate to applications made during the earlier months of 1914, and in many cases the date applied for under the Convention is much earlier. An example of this is the German anti-aircraft searchlight patent (18,920/14) abstracted in our Patent Record last week, the date of application in this country being June 9th, 1914, and the Convention date June 21st, 1913. This was not, as might have been thought, a case of the Germans endeavouring to teach us how to repel their own aerial attacks. An easy way of ascertaining whether an application was made before or after the declaration of war is to see whether the number is earlier or later than 18,250/14, which was the number of the first specification with a date subsequent to August 4th, 1914. German and Austrian applications are still being received under the new procedure, although no patents are to be granted on them during the war, but it is noticeable that the number of specifications of German origin published bearing numbers higher than the above is small. Thus in the list of specifications published to-day, out of the twenty-one (including all subjects) before 18,250/14, over half are, so far as can be judged, of German origin, while among the remaining sixty of later date only eight names apparently of German applicants appear, and in nearly all cases the Convention date is before August 4th, 1914. Again, in the list of applications published in last week's official journal, only one or two German names can be found in the whole 318, although there are quite a number from allied or neutral countries. Incidentally, it may be mentioned that of all these applications forty-three, or 18.7 per cent., relate directly to war material. Renewal fees appear to continue to be paid on German-owned patents to a certain extent, but, as far as we can see, the proportion of German names among the list of patents void through non-payment of renewal fees is larger than usual.

Royal Engineers (Wireless Section).—There are several commissions available in the Wireless Section of the Royal Engineers for general service during the period of the war. Applications are invited from candidates with good technical knowledge of wireless telegraphy and used to the control of men. Applications should be addressed to Major Handley, O.C., Wireless Training, Oxford Cottage, Sandown, I.W.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,459.

Large motors of the self-starting synchronous type are not generally suitable for starting against any considerable torque, owing to the high starting current. It is, however, possible to improve the starting conditions by using an induction motor rotor as the field and inserting resistance across the slip-rings. A disadvantage of this arrangement is that the voltage induced across the slip-rings at starting may be 1,000 or 1,500 volts, which requires special precautions in the way of insulation, &c. Is there any simple method of overcoming this trouble? Several self-starting machines have been built recently with their exciters series wound. Have series-wound exciters any particular advantage over the more usual shunt-wound exciters?—J. I. E.

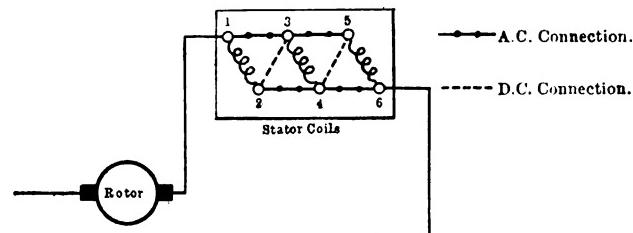
(Replies must be received not later than first post, Thursday, Sept. 16th.)

ANSWERS TO No. 1,457.

I HAVE an electric drill, $\frac{1}{4}$ in. capacity, 110 volts, single-phase, squirrel cage rotor, and wish to run this off either A.C. or D.C., same voltage. The rotor has been wound and fitted with a commutator, and the machine runs fairly well as a repulsion motor, but does not develop full torque. As a series D.C. machine it gets excessively hot, after a few minutes' run; have tried various means of keeping cool, such as fans, &c., but without success. Are there any means I can adopt to enable this machine to be run satisfactorily as a repulsion or series machine on A.C. or series, or shunt on D.C. The frequency of A.C. supply is 60.—W. E. L. (Canada).

The first award (10s.) is made to "H. J. E." for the following reply:—

In order to simplify the connections, it will be advisable to re-design the machine to work as a series motor on either A.C. or D.C. When running as a series motor on D.C. the back e.m.f. of the armature is equal to the applied pressure minus the drop in the field and across the brushes. Whereas with a series connection on A.C. the back e.m.f. of the armature is equal to



the vectorial difference between the applied pressure and the transformer voltage of the stator winding. This latter voltage will most probably be as much as $0.6 \times$ applied pressure, so that the voltage on the armature is far larger on D.C. Also the current taken by the motor for the same horse-power at the same speed is higher on A.C. on account of the power factor being less than unity in addition to the lower efficiency. Consequently, not only is a stronger flux per pole required on

D.C. due to the higher volts on the armature, but also more turns per pole are needed on account of the reduced current. By working out the saturation curve of the machine it would be found that approximately three times as many turns are required per pole on the stator for the same voltage on D.C. Moreover, this is corroborated by experiment. Therefore the stator should be stripped and re-wound with $0.67 \times$ existing turns per pole, using three wires in parallel, the combined section being equivalent to the section of the stripped wire. Then if all six ends of the stator winding are brought out to a terminal board on the carcase, as shown in the accompanying sketch, it is quite a simple matter to place links across terminals 2 and 3, 4 and 5 for the D.C. circuit, and across terminals 1, 3, and 5, 2, 4, and 6 for the A.C. circuit. Incidentally, if the armature has a two-pole winding, or a four-pole wave winding, the wire should have one half the section of the stator copper, and the turns in series between the brushes should equal the stator turns in series, with the A.C. connection. In this manner the same horse-power will be obtained at the same speed on 110 volts, 60 cycles as on 110 v. D.C.

The second award (5s.) is given to "BELFAST," who writes as follows :—

In a D.C. motor the applied voltage has only to supply the voltage drop due to the resistance of the windings, and to neutralise the back e.m.f. But in an A.C. motor the terminal voltage has also to supply the voltage drop due to the inductance of the windings; and in a small motor this drop is a considerable fraction of the total voltage. It is therefore evident that for the same terminal voltage a greater portion of it is available for the production of mechanical power in the case of a D.C. than in that of an A.C. motor. This explains why the machine in question, when running off A.C., cannot be expected to develop full torque. The latter can only be varied by altering the position of the brushes, unless the machine is re-wound. It is impossible to say whether the torque could even then be improved without knowing the particulars of the present windings. The best thing is for "W. E. L." to experiment with the brush position, and also to try running the machine as a series A.C. motor. The latter would be a much more convenient method, since no alteration in the connections would be required when changing over from A.C. to D.C., or vice versa.

With regard to the overheating experienced when running off D.C., this trouble is due to the fact already mentioned, namely, that a motor is capable of a much greater output off D.C. than off A.C., the supply voltages being equal. Fans, &c., fitted on small motors produce very little effect, and the only remedy is to reduce the speed, either by re-winding the armature or by inserting resistance in series. Re-winding with a larger number of conductors would leave its characteristics as a repulsion motor practically unaltered, but as a series A.C. motor it would exert less torque than at present. The employment of a series resistance entails the waste of a certain amount of power in it, but that is generally of secondary consideration in the case of very small motors. The disadvantages of a shunt arrangement for such a machine outweigh its advantages.

Question No. 1,456.—It has been pointed out by a correspondent that the three curves given in the first reply to this question, published on p. 365 of our issue of Sept. 2nd, are not strictly accurate, in that they show zero torque at zero speed, which could not be the case, or the motor would not start. The fact is, of course, that a stator current, however small, produces a torque, and the motor starts rotating when this torque just exceeds that due to friction. We reproduced the curves exactly as drawn by "W. H." and regarded them only as very rough approximations to show the general character of the action.

CORRESPONDENCE

ELECTRICAL TRADE AFTER THE WAR.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—It may be interesting for your readers to be impressed with a few facts which are just brought to my attention. Although they apply to the Spanish market, their general consequences will bear also on all neutral markets and indirectly on the Allied markets.

The position of the electric lamp industry in Spain was, up to a few weeks ago, almost the following : Spanish industry produces Spanish-made lamps at cheap prices, yet there was an opening for foreign industry in spite of the heavy import duties in Spain. Since the entry of Italy into the war, German lamps were almost entirely prevented from entering Spain. Now, however, I have definite information that German well-known brands are again entering in Spain from Switzerland, where factories have been started under Swiss names and whose products are allowed to pass through France as being Swiss goods. In such a way those so-called Swiss lamps are offered approximately 30 per cent. cheaper than any other lamps from the Allied countries.

It is urgent that the attention of the French Government

should be drawn to the fact that some Swiss products are not purely Swiss, but conceal German origin. If we fail to stop this kind of competition during the war, what will happen after the war, when apparently all German goods will be naturalised Swiss or Dutch? This question is of the highest importance, and steps should be taken in France to examine the position. Incidentally, I wish to point out that the very low quotations adopted now by German manufacturers in the lamp business for their export goods show that, as has been told in different quarters, the German industry is working heavily on stock and making ready to overflow all neutral markets and thence our own countries after the war if we do not stop the leakage effectively, not merely with certificates of origin, but by an absolute control of the producing industries and their ultimate destination. We would be really too simple if, after the terrible strain put on all the Allied countries, we should not be intelligent enough to reap also the benefits of our sacrifices.

Yours faithfully,

R. STEYLAERS.

Anglo-Continental Sales Co.,
7 Idol Lane, E.C., Sept. 2nd, 1915.

THE INCREASE IN LONDON WIREMEN'S WAGES.

To the Editor of ELECTRICAL ENGINEERING.

September 1st, 1915.

SIR,—The District Secretary of the London District Electrical Trades Union has circularised the Electrical Press, stating that Sir David Harrel, the Arbitrator, has awarded their members an advance of 1d. per hour, which, coupled with the penny advance obtained by the Union last year, constitutes an increase of 1½d. per hour, in a little over fifteen months, for electrical wiremen and fitters in the Metropolitan district.

This statement is extremely misleading and avoids the main facts, the intention being, no doubt, to claim a series of victories over the employers, who, however, stand in the happy position of knowing that the penny advance was offered by the Masters, and accepted by the Union after the strike, which from the men's point of view was not a brilliant achievement. In addition to this, an advance of 1½d. per hour was demanded by the men and refused. However, the Masters agreed to arbitration, realising that an increase of wages was justified during the present national crisis, with the result that the Arbitrator awarded half the amount demanded.

Although this award applies only to members of the London Union and, strictly speaking, is limited to such, the members of the London Electrical Masters Association have decided to apply the increase to all employees, *Union and non-Union*, although no agitation has been apparent among their non-Union employees.

Yours, etc.,
W. ELLERD-STYLES.

[ELECTRICAL ENGINEERING published the Arbitrator's award in full on August 19th (p. 351), and did not publish the statement referred to by Mr. Ellerd-Styles as misleading in the first part of his letter.—ED., E.E.]

THE HEMMING CONDUIT GRIP

THE latest form of the Hemming conduit grip is slightly different from the original design, which was described in ELECTRICAL ENGINEERING, June 18th, 1914 (p. 381). In the present pattern illustrated here, a pin recessed to fit the curve of the bore of the socket passes through the boss in a direction tangential to the tube, and carries a series of teeth, which, on the tightening of the nut which draws up the pin, locks the tube and at the same time makes excellent metallic contact



HEMMING PATENT CONDUIT GRIP.

through the enamel. It can be used with any class of tube, close joint or seamless, and locks firmly even if the tube is slightly under diameter. Only the screwing up of the nut is required to establish continuity, and the tube can be released when necessary by unscrewing the nut and slightly tapping the pin. A number of sizes can be obtained from the makers, the Hemming Conduit Grip Co. (Hatherton Works, Walsall).

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 2nd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

4,352/14. Finding the Position of Ships at Sea. A. STCHENSONOVITCH AND SOC. DE CONSTRUCTIONS ELECTRO-MÉCANIQUES CI-DEVANT SOC. DUFILON, CONSTANTINOVITCH & CO. A method of determining the position of ships at sea by measuring the time lag between the reception of simultaneously-sent Hertz waves and submarine or other acoustic signals from two fixed points on the shore. (Nine figures.)

16,860/14. Protective System. SIEMENS-SCHUCKERTWERKE. Protective arrangements in which the time lag of the release of each of the circuit breakers depends on the current strength but has a lower limiting value, which is set in accordance with the position of the circuit-breakers in the circuit to be progressively greater for the circuit-breakers near the main busbars. (Five figures.)

19,729/14. Incandescent Lamps. DEUTSCHE GASGLÜHLICHT GES. (AUERGES.) Gas-filled lamps in which the bulb is provided with an elongated neck fitted with one or more internal baffle plates to keep the space near the seal of the leading in wires free from circulating currents of hot gas. (One figure.)

21,650/14. Cables. E. C. R. MARKS (*Aluminium Co. of America*). A composite cable for overhead work with stranded core and envelope of different metals laid up with an initial tensile stress on the strands differing according to the strength of the metals employed, so that each part of the complete cable bears such a proportion of the load due to ice and wind pressure that they all reach their respective elastic limits at the same time. (One figure.)

23,170/14. Bullet Localiser. D. FINDLAY. A probe consisting of a silver tube insulated from a central rod, the head of which protrudes from and is also insulated from the tube, is connected to a telephone circuit. A sound is heard in the telephone when the flow of current between the tube and the rod through the tissues is redistributed by the proximity of a metal object. (Four figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS AND TRANSFORMERS: CREEDY [Variable pole machines] 18,887/14; PARSONS [High-speed rotors] 18,924/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Speed control of motors] 19,057/14; WILSON AND WRIGHT [H. T. windings] 20,959/14; SVENSKA TURBINENFABRIKS AKTIEBOLAGET LJUNGSTRÖM [Motor regulation] 7,091/14.

Instruments and Meters: LANDIS & GYR [Prepayment meters] 18,464/14; ARM [H. C. meters] 20,786/14.

Switchgear, Fuses and Fittings: VON ARCO AND MEISSNER [A.C. Relays] 252/14; VAN HAERMEA BUMA [Mercury switches] 18,872/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Electromagnetic] switches] 19,794/14; BENNETT and JEFFCOAT [Lampholders] 21,798/14; TUCKER and CRABTREE [Switches] 5,717/14; MIDGLEY and VANDERVELL [Lampholders] 8,332/14.

Telephony and Telegraphy: SYKES and FORD [Wireless telegraphy] 12,277/14.

Traction: GARDNER [Signalling] 18,954/14; MOSSAY [Tractors] B.T.-H. CO. (G.E. CO., U.S.A.) [Speed control of motors] 20,606/14.

Miscellaneous: HARRY W. COX & CO. and DONNITHORNE [Electro-medical apparatus] 18,660/14; MORTLEY [Dynamo-battery electric systems] 18,737/14; GREEN and LANDON [Mine signalling] 18,780/14; WALKER [Electric clocks] 19,818/14; GES. FÜR ELECTRO-OSMOSE [Electro-osmotic impregnation] 19,849 and 21,189/14; B.T.-H. CO. (G.E. CO., U.S.A.) [X-ray devices] 21,389/14; BENITEZ [Generation of currents] 5,591/14; MIDGLEY and VANDERVELL [Diaphragm horns] 7,088/14; LUND [Magnetic sun-dial] 8,052/14; CLAUDE [Neon tubes] 8,312/14; FRANKFURTER MASCHINENBAU, A. G. VORM, POKORNY & WITTEKIND [Coating electrically-worked tools] 9,477/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Arc Lamps: A. E. G. [Enclosed arc lamps] 11,660/14.

DYNAMOS, &c.: U. S. LIGHT & HEAT CORPORATION [Dynamos] 11,510/14.

Miscellaneous: FRANKFURTER MASCHINENBAU A.G. [Electric tools] 11,264/14.

Amendments allowed

9,582/14. Electric Railways. R. E. STUART. Correction of a clerical error has been allowed in this specification, which is for a system of driverless railways for carrying mails, &c.

18,711/14. Wireless Telegraphy. W. C. WOODLAND. This specification has been amended by way of disclaimer. It describes a method of increasing the group frequency or tone pitch heard in the receiving telephone by dividing up a multi-phase alternating current at the sending end into a plurality of intermediate phases, and energising a corresponding number of oscillatory circuits successively.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:-

18,329/01. Circuit Breakers. B.T.-H. CO. (E. M. HEWLETT). A number of details of a form of automatic circuit breaker for heavy currents in the main and auxiliary carbon-copper contacts operated by independent toggle mechanisms and means to render the impedance of the auxiliary circuit as low as possible.

18,330/01. Train Control. B.T.-H. CO. (F. E. CASE). A complete multiple unit contactor control system for electric traction in which a separate reverser is not used.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: VOGEL [Flame carbons] 11,442/03.

DYNAMOS, MOTORS, and TRANSFORMERS: D. BALACHOWSKY and P. CLAIRE [Prevention of sparking] 23,743/02; V. A. FYNNE [Single-phase motors] 10,611/08.

Electrochemistry and Electrometallurgy: L. TRINKHARN [Electro-deposition] 11,498/06.

Incandescent Lamps: B.T.-H. CO. (G.E. CO., U.S.A.) [Squirted filaments] 11,409/06; SIEMENS & HALSKE A.G. [Tungsten filaments] 11,716/07.

Telephony and Telegraphy: A. POLLAK, G. EGGER, and F. SILBERSTEIN [Developing photographic records from high-speed telegraph receivers] 11,596/02.

Traction: SIEMENS-SCHUCKERTWERKE GES. [Interpole traction motors] 9,637/08; E. M. MUNRO and RAILLESS ELECTRIC TRACTION CO. [Current collectors] 11,947/09.

Miscellaneous: A. J. BOULT (H. S. MILLS, U.S.A.) [Electric automatic violin player] 10,618/05; W. K. KEYS (GENERAL ACOUSTIC CO.) [Microphones] 11,754/07; F. DOGILBERT [Electrical apparatus for production of music sheets] 11,811/07; NEW IGNITION SYNDICATE and W. J. L. SANDY [Primary batteries] 11,035/08; B. E. R. NEWLANDS and R. M. PARKINSON [Primary batteries] 11,926/09.

CATALOGUES, PAMPHLETS, &c., RECEIVED

INDUSTRIAL LIGHTING.—An interesting booklet from Holophane, Ltd. (12 Carteret Street, Queen Anne's Gate, S.W.), deals with the application of special forms of the well-known Holophane prismatic glass reflector to the lighting of industrial premises. The type of reflector dealt with consists of the ordinary glass reflector of the intensive, extensive, focussing, and other types over which aluminium cases are spun in such a manner that they completely seal up both ends of the reflectors. This of course in no way interferes with the efficiency of the inner reflecting surface of the glass, and protects the outer surface from dust. The little work is a great deal more than a catalogue of these excellent reflectors, but gives a quantity of well-chosen and well-presented information on works lighting, particularly as regards the degree of illumination admissible with different classes of machinery, &c., while the curves and tables worked out for each design of reflector enable the height, spacing, &c., of any size of lamp up to and including the large "half-watt" units in any style of reflector to be readily ascertained. The importance from a manufacturing efficiency point of view of adequate and correctly directed lighting is now too well known to need insisting on here.

DYNAMO MANUFACTURERS' MACHINERY, &c.—A number of special machines for the equipment of electrical manufacturing works are put forward in a catalogue from

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.



Made in
all sizes of
Ordinary & Stout
Substances
to suit varying
Voltages.

BEST QUALITY
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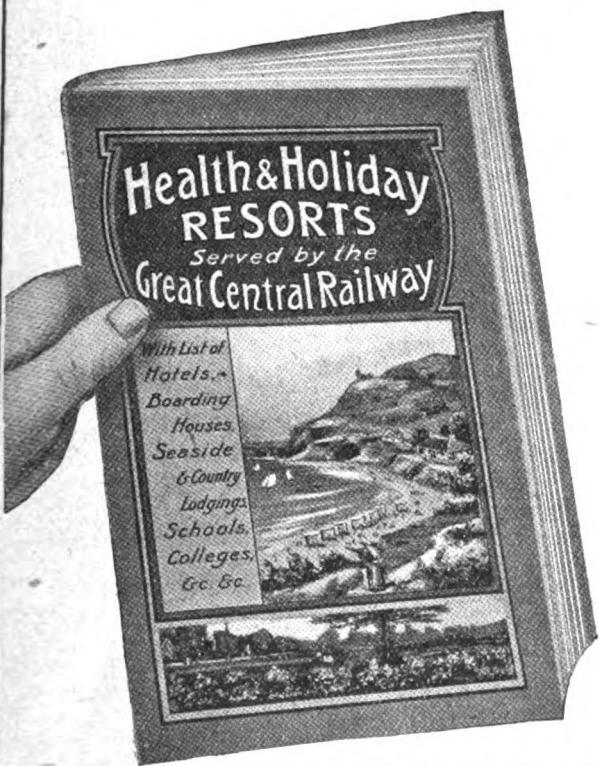
COMPLETE INSTALLATIONS FOR

WARSHIPS, MERCANTILE VESSELS, MINES, POWER STATIONS, ETC.

Adopted by the British Admiralty, Foreign Governments,
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Electrical Generating Stations.

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This Guide contains GOOD ADVICE & USEFUL INFORMATION

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SAM FAY, General Manager.

Neville's, Ltd. (Liverpool). The list is very extensive, and includes coil-winding machines in a great number of sizes for both field coils and arc lamp, bell, and other small coils, taping machines for armature coils, &c.; armature banding lathes, papering machines for core plates, circle and ring shearing machines, and armature disc notching presses. Other special plant comprises hydraulic presses for forcing armatures on and off shafts, vacuum drying and impregnating plant, bending and sawing machines, &c. We understand that the greater proportion of this machinery is of British manufacture.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC HEATERS.—The Bastian Electric Heating Syndicate, Ltd. (185 Wardour Street, W.), have issued a new catalogue of their well-known "Quartzalite" heating apparatus. Many designs of radiator are included which employ the Bastian glower consisting of an elongated helix of a special wire supported by a quartz tube, and mounted in clips. A number of the designs have been specially prepared for shipboard work, and a newer form of heater in which the elements are enclosed in iron pipes is made for the heating of large premises where a considerable radiating surface at a moderate temperature is an advantage. The latest forms of the well-known "Pygmy" hot plate and larger sizes of electric stoves, as well as ovens, water heaters, irons, and kettles, are also represented. The firm now announces a uniform trade discount of 20 per cent. off the prices of all their apparatus, instead of the varying discounts prevailing hitherto.

ACCUMULATOR ACCESSORIES.—A leaflet from Cookson & Co., 25 New Oxford Street, lists a number of accessories for the accumulator trade, including india-rubber corks and collars, glass vents, hydrometers, voltmeters, &c.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Amble.—Having had a disagreement with the Gas Company with regard to its street lighting contract, the Council is attempting to obtain a supply of electrical energy from the Broomhill Collieries, Ltd. The Surveyor is preparing estimates of the cost of street lighting.

Bury.—Extensions at the electricity works estimated to cost £7,225 have been sanctioned by the L.G.B.

South Africa.—The Johannesburg Council requires 1,000 single-pole 25-ampere house service cut-outs. Further particulars at 73 Basinghall Street, E.C.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Airdrie.—Garage and offices (£2,400). Airdrie & Coatbridge Tramways Co.

Dundee.—Cinematograph theatre in Gray Street. Broughty Picture House, Ltd.

Edmonton.—Extensions to military hospital (£9,000).

Manchester.—Cinematograph theatre, Hulme. Architect, P. Cummings.—Cinematograph theatre, Oxford Road. Architects, T. Cook & Sons.—Factory, Cheetham. Architects, Thorpe & Collier.

Wigan.—New spinning mill. Northern Coarse Spinners, Ltd., 51 King Street.

Miscellaneous

Burnley.—Electrical goods for the Board of Guardians.

Edmonton.—Six months' supply of electric lamps for the Guardians. Clerk, White Hart Lane, Tottenham. Sept. 22nd.

London: Kensington.—Six months' supply of electrical fittings and lamps for Guardians. Clerk, Marloes Road. Sept. 23rd.

New Zealand.—A Government Department requires electrically-driven letter sealing machines. The type at present in use is of foreign manufacture, but it is not so durable as could be wished, and no spare parts are obtainable. Communications to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington.

Warrington.—Electrical goods for the Board of Guardians.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £82 to £83 (last week, £84 to £85).

Liquidation.—Mr. Arthur Faraday Hawdon, Electrical Engineer, Elmfield Gardens, Gosforth, Northumberland, has been adjudicated a bankrupt.

APPOINTMENTS AND PERSONAL NOTES

Mr. C. L. Oechsner, who has for many years been in charge of the Rugby advertising of the British Thomson-Houston Co., left last Thursday on his way to Boston, from whence he proposes to go to Schenectady and New Orleans, then to the Pacific Coast, California, and to come back again via New York.

The works' employés of J. H. Tucker & Co. (Hay Mills, Birmingham) have presented Mr. J. B. Tucker, who is the son of the founder and present head of the firm, and holds a commission in the R.E., with a service revolver on the occasion of his leaving for the Front. The office staff presented him with a silver cigarette case, and the officials of the firm asked his acceptance of a sword, sword knot and scabbard, suitably engraved. The presentations were made on Friday last amid great enthusiasm.

An electrical engineer is required for lecture and laboratory work in the evening technical class of the North-Eastern Railway Institute, York. Applications to the Secretary.

We are informed by the Magneta Time Co., Ltd. (14 Soho Square, W.), that Mr. W. J. Polyblank is no longer in any way connected with this Company.

Switchboard attendants are required in the West Bromwich and Stockport Electricity Departments. Applications in both cases to Borough Electrical Engineer.

LOCAL NOTES

Aberdeen: *Reduced Electricity Revenue.*—The Electricity Committee, like so many others, is faced with the difficulty of meeting the increased cost of coal, etc., but prefers to add 15 per cent. to the consumers' accounts rather than to increase the actual charges per unit.

Accrington: *Showroom.*—A sub-committee has been appointed to consider the question of whether the Electricity Department's showroom shall be continued.

Belfast: *The Fire at the Electricity Works.*—At the meeting of the Corporation last week some serious suggestions were made with regard to the fire at the electricity works coal bunkers, reported in our last issue, and as a result it was decided that the whole of the facts regarding the outbreak should be inquiry into specially.

Dublin: *The Lighting Committee.*—A recommendation is to come before the Corporation for the amalgamation of the Lighting Committee with the Electric Supply Committee.

Eastbourne: *Economy in Electricity Department.*—In reply to a request from the Finance Committee, the Electrical Engineer reports that all possible economies in expenditure on permanent works have already been considered and made. The Electricity Committee has decided to postpone the purchase of a new boiler, chimney, and auxiliary plant, together with the extension of the cooling pond and tower, and it is not anticipated that any large expenditure will be required during the present financial year.



Eccles: *Electricity Accounts.*—There was a net profit of £632 on working of the electricity undertaking last year after meeting capital charges.

London: *Fulham: The Linking-up Scheme.*—Some difficulty appears to have arisen with regard to the completion of the linking-up scheme between Battersea, Fulham, and Hammersmith, of which particulars have already been given in our columns. The London County Council and the Board of Trade have agreed to the scheme, but the Hammersmith Council proposes the insertion of a clause in the agreement to the effect that in the event of Hammersmith not receiving sanction to incur the necessary expenditure to enable it to join in the scheme within the next three or four months, such agreement should not be binding upon Hammersmith, and it would therefore drop out of the scheme. The Fulham Council, however, regard this as likely to lead to unforeseen complications, and has passed a resolution rescinding the previous agreement to join with Battersea and Hammersmith, and proposes to proceed with the scheme with Battersea alone. Contracts have already been entered into with W. T. Henley's Telegraph Works Co., Ltd., and the British Electric Transformer Co.

Hampstead: *Reduced Electricity Revenue.*—In consequence of the reduced lighting due to the war, the number of units sold last year dropped by some 322,000 units, and the revenue was likewise less. The net surplus was £2,767 as against £6,258 in the previous twelve months. The expenditure increased mainly in respect of management expenses and active service pay.

Lytham: *Bulk Supply.*—The L.G.B. has now intimated that it is unable to sanction a loan for the scheme under which the St. Anne's Council would have supplied Lytham with electricity in bulk.

Manchester: *Proposed Investigation Committee.*—The motion by Councillor Ross Clyne for the appointment of a Special Committee to inquire into the working and control of the Electrical Department, together with the appointment of an individual expert, referred to on page 334 of our issue for August 5th, duly came before the monthly meeting of the Corporation last week. It met, however, as was not altogether unanticipated, with little sympathy, and eventually was rejected, only the proposer and seconder of the resolution voting for it. As we pointed out in our issue for August 5th, the resolution was partly aimed at the proposal to build the new Barton Power House for which the Treasury's consent has now been obtained, and against which there has been a certain amount of opposition by the Ratepayers' Association. Against this small amount of opposition is the fact that the demand for electricity in Manchester is necessarily making huge strides, and manufacturers of munitions in the area have pointed to the great harm which would be done if the Barton Power House is not proceeded with.

Swansea: *Increased Cost of Production.*—The Electricity Committee has considered a suggestion by the Borough Electrical Engineer to meet the increased cost of production due to the war amounting to £4,400 for the current year. A scheme of increased charges, together with the application of a meter rent, is estimated to bring in about £3,300, which, added to the profit calculated for the year, will be sufficient to meet the increased expenditure. The recommendation has been adopted and will become operative from the September meter reading.

Warrington: *Improved Coal Consumption.*—The report of Mr. F. V. L. Mathias, the Borough Electrical Engineer, upon the working of the electricity undertaking for the year to March 31st, shows that there was a net profit of £1,819 after meeting capital charges. The coal consumption shows the satisfactory improvement of 6 per cent., the quantity burned per unit generated being 3.98 lbs.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Clyde Valley Electrical Power Co.—The profit for 1914, including £11,535 brought forward, was £54,095. After transferring £18,709 to depreciation, it is proposed that £4,276 be placed to reserve, £10,000 applied for writing down legal expenses, the dividend on the preference shares to October 31st, 1915, to be paid, and £12,450 carried forward.

British Electric Transformer Co.—An interim dividend at the rate of 6 per cent. per annum, less tax, on the ordinary shares for the past half year is declared.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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The Engineering Journal of the Electrical Industry

PUBLISHED EVERY THURSDAY. Price 1d.

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Rates for Small Prepaid and Official Advertisements, see p. vi.

Other Advertisement Rates on Application.

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Letters for Insertion, *Tuesday first post.*

Small Advertisements and Official Announcements, *Wednesday first post.*

Displayed Advertisements, *Tuesday first post.*

Corrections in Standing Advertisements, *Monday first post.*

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Telegrams: "Circling, Fleet, London."

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Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

THE number of names on the register of the Electrical Emergency Service now considerably exceeds the demand, and, until more central stations adopt the scheme, we can hold out little hope of finding active work for those offering part-time service. Readers desiring to offer full-time service as charge or shift engineers at central stations, or as switchboard attendants, are recommended to insert and reply to advertisements in the ordinary course (p. 377).

THE first report of the Home Office Committee on Lighting of Factories and Workshops has been issued. The necessity of adequate lighting is insisted on, and minimum values of illumination to be observed in different circumstances are specified (p. 378).

SOME particulars of the Barton power station now being built for the Manchester Corporation Electricity department were given in a Paper before the British Association by the Chief Engineer, Mr. S. L. Pearce (p. 379).

OTHER Papers read before the Engineering Section included a description of a self-adjusting commutating-pole system by Prof. Miles Walker, an account of experiments on the heating of iron by high-frequency magnetisation by Mr. N. W. McLachlan, and one giving results of experiments regarding the effect of triple frequency currents on transformer core losses by Messrs. H. M. Lacey and C. H. Stubbings. Prof. E. Wilson also gave results of exposure tests of certain aluminium alloys (pp. 379, 380).

A REPORT presented to the Economics Section of the British Association deals with the employment of

women in the electrical industry before, during, and after the war (p. 380).

A POINT connected with the rating of crane motors is discussed in our Questions and Answers columns (p. 381).

AMONG the subjects of specifications published at the Patent Office last Thursday are relays for wireless telegraphy, A.C. motors, X-ray tubes, and locking lamp-holders (p. 382).

THREE Papers on wireless telegraphy read before the British Association are referred to under "Telephony and Telegraphy" (p. 382).

CABLE is required at Worcester; boiler feed-pump and cooling tower at Wakefield; a number of Guardians in various parts of the country require lamps and electrical fittings; and there is the probability of electric omnibuses being adopted at Burton-on-Trent (p. 383).

THE St. Pancras Electricity Committee proposes to allocate the available balance, less £4,000, to relief of rates.—It is stated that Parliamentary powers are to be sought for a water-power scheme in Ireland.—The Edinburgh Electricity Committee has called upon its coal contractors to supply at a price in accordance with the Act limiting prices (p. 384).

An interim dividend of 5 per cent. is recommended by the British Insulated & Helsby Cables, Ltd. (p. 384).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK ENDING SEPTEMBER 25TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Drills, 6.30 to 7.30; 7.30 to 8.30.

Monday: Section III., technical instruction. Section I., musketry at range. Sections II. and IV., squad drill or signalling.

Friday: Section IV., technical instruction. Section II., musketry at range. Sections I. and III., squad drill or signalling.

Attention is called to the fact that the War Office has now decided to employ certain Volunteer Training Corps in guarding waterworks, railways, and prisoners.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Obituary.—Not long after the death of Mr. R. Kaye Gray, of the India Rubber, Gutta Percha, and Telegraph Works Co. (Silvertown), there has passed away, in Mr. Matthew Hamilton Gray, his younger brother, who died at the age of 61 in Scotland on Sept. 2nd, and was buried at East Wickham on Sept. 6th. Like his brother he had played a prominent part at the Silvertown works, but had retired from active work there some seven years ago. His early career was that of a mining engineer, but subsequently he specialised in submarine cable work, and, first as assistant and then as chief engineer, he supervised the cable-laying and repairing operations of the Silvertown fleet in many parts of the world.

THE ELECTRICAL EMERGENCY SERVICE

FOR the past few weeks, nothing has appeared in our columns with regard to the Electrical Emergency Service inaugurated by us last April. A considerable number of our readers, who offered their services to fill the gaps caused by switchboard attendants joining the colours, have been working in this capacity for some months, and their action has been greatly appreciated. There are many more, however, whose assistance, offered with equal willingness, has not been called for, although their names have been on the register of the Electrical Emergency Service for many weeks. To these a few words of explanation are due.

As our readers already know, one of the immediate results of the declaration of war last year was the calling up of a large number of Navy and Army reserve men engaged at central stations and sub-stations, and the enlistment of numbers of the younger men. The switchboard staffs were being depleted at a very rapid rate, and although it was at the period of light summer load, it was soon evident that the situation was one to be regarded with some apprehension. The more or less automatic adjustment took place at first: men transferred from the provinces to London and from smaller stations to larger ones, and the smaller stations filled up the gaps to some extent from outside or found other means to meet the emergency. With the increasing load—not only the normal increase, but also the growing power load for works manufacturing war material—it soon became apparent that some more definite step was necessary, and, with the exception of the works supplying nothing but tramways, permission for men to leave was refused, and the War Office issued instructions to recruiting officers not to accept employés of electricity works for enlistment. Many men of military age and capable of making good soldiers were thus prevented from joining the colours, and the main object of our Electrical Emergency Service was to enable the electricity works to give permission to enlist with greater freedom. We enrolled in the service men possessing electrical experience and able to take over switchboard duties with little or no additional training or instruction, in some cases for full-time and in other cases for part-time work. The scheme has worked well up to a point, but it was soon found that the electricity works who had power to exercise their veto mostly preferred to keep their present men rather than to incur what they thought would be the risk of relying on the work being done by men who had not recently been in charge of switchboards. Casual vacancies are now so relatively few that they are being filled up by the insertion of advertisements in the ordinary course. Although, therefore, as we have said, many men in the Electrical Emergency Service are doing good work on central station switchboards—both in electricity and tramway stations—yet we have many more on the register waiting for their services to be accepted by the adoption of our scheme by additional central stations.

Incidentally, we may mention that, in selecting the names from our register for enrolment as active members of the Electrical Emergency Service, we have given the preference to men who are over military age or are prevented from joining the Army or Navy by some other good reason, and that, in many cases, our insistence on this has had the result of sending recruits directly as well as indirectly to join the forces. In other cases, readers who have been unable to find employment in the Electrical Emergency Service have joined the ranks of munition workers.

To aid us in keeping the register of our Electrical Emergency Service in order and up to date, we beg any of our readers who have been placed on the register and have since found other employment for their spare or full-time activities to notify us as soon as possible.

THE LIGHTING OF FACTORIES

THE first report of the Home Office Committee on lighting in factories and workshops has now been issued. This committee was appointed in 1913 and consisted of Dr. R. T. Glazebrook, Mr. L. Gaster, Prof. E. Gotch, Mr. J. H. Parsons, Mr. W. C. D. Whetham, and Sir Arthur Whitelegg (Chief Inspector of Factories). On the death of Prof. Gotch, Prof. C. S. Sherrington was appointed. Mr. D. R. Wilson (Inspector of Factories) and Mr. C. C. Paterson (National Physical Laboratory) acted as secretaries.

The inquiry in the first instance was limited to the engineering, textile, and clothing trades. A large number of factories were visited, and experiments were conducted at the National Physical Laboratory. Investigations were also made, which showed that a considerable number of accidents,

in which inadequate lighting was a contributory cause, occur every month, and that bad lighting has harmful physiological effects on workers, while good lighting conduces to cleanliness, health, and manufacturing efficiency.

The committee recommends that there should be a statutory provision: (a) requiring adequate and suitable lighting in general terms in every part of a factory or workshop, and (b) giving power to the Secretary of State to make Orders defining adequate and suitable illumination for factories and workshops or for any parts thereof or for any processes carried on therein.

Broadly, the illumination may be said to be adequate and suitable provided that it is sufficient for the proper carrying out of the work both as regards quality and output, and there are no lighting conditions prejudicial to the health, comfort, and safety of workers.

The recommendations further lay down that in order to satisfy these requirements, the illumination should comply with the following requirements: . adequacy; a reasonable degree of constancy and uniformity of illumination over the necessary area of work; the placing or shading of lamps so that the light from them does not fall directly in the eyes of an operator when engaged on his work, or when looking horizontally across the workroom; the placing of lights so as to avoid the casting of extraneous shadows on the work.

The following recommendations define the minimum illumination implied in the terms adequate and suitable in different circumstances: over the "working areas" of workrooms the illumination measured on a horizontal plane at floor level shall not be less than 0'25 foot-candle, without prejudice to the illumination required for the work itself; in all parts of foundries in which work is carried on or over which any person is ordinarily liable to pass, the illumination measured on a horizontal plane at floor level shall not be less than 0'4 foot-candle; in all other parts of factories and workshops over which persons employed are liable to pass the illumination measured on a horizontal plane at floor level shall not be less than 0'1 foot-candle; in all open places in which persons are employed during the period between one hour after sunset and one hour before sunrise, and in any dangerous parts of the regular road or way over a yard or other space forming the approach to any place of work, the illumination on a horizontal plane at ground level shall not be less than 0'05 foot-candle.

These values are suggested without prejudice to the special illumination required for the carrying out of the work, which naturally varies greatly according to the nature of the operations. At present the Committee are not prepared to recommend standards of illumination for these purposes, which require further investigation. A further recommendation provides for exemption of individual cases, and of factories to which the above requirements could not be applied, and the case of shipbuilding yards is to receive separate consideration. Finally, suggestions are made for the periodic cleaning of windows.

In conclusion, the Committee point out that the minimum values prescribed are considerably lower than those proposed by many witnesses and are also lower than those found to exist in the majority of factories visited. In many cases manufacturers would naturally prefer to provide a substantially higher value than that indicated. The intention has been to propose values which can be adopted as a practical legal minimum without causing hardship, and would serve the purpose of raising the level of illumination in those factories which are behind modern practice in regard to methods of illumination. The Committee did not feel justified in drawing any distinction between direct, indirect, and semi-indirect lighting, nor between systems which differ in the colour composition of the light. Similarly the standards are intended to apply equally to natural and artificial lighting; that is to say, when the natural illumination falls below the prescribed limits, it must be supplemented or replaced by artificial illumination.

Data are given in appendices to the report which will be of service to those engaged in designing new factories and in examining the adequacy of lighting in existing buildings.

Meter Approved.—The Board of Trade has approved of the Murday recording volt-meter types M.R.1 and M.R.2 for continuous current and alternating current respectively.

Engineers in the American Army.—It is announced in the proceedings of the American Institute of Electrical Engineers that a movement is on foot for the formation of a United States National Reserve Corps of military engineers. A joint committee has been formed among the American Engineering Societies.

THE BRITISH ASSOCIATION AT MANCHESTER

A NUMBER of Papers of electrical interest were read at the meetings of Section G (Engineering), on Thursday, Friday, and Saturday of last week. The proceedings on the Wednesday commenced with the reading of Dr. Hele-Shaw's Presidential Address to the Section, referred to on page 370 of our last issue.

The New Manchester Electricity Works.

At the meeting on Thursday an interesting account was given by Mr. S. L. Pearce (City Electrical Engineer, Manchester) of the new Barton power house which is building for the Corporation. This scheme has received a good deal of public attention in Manchester since its inception, but the Treasury consent to borrow the necessary money has now been obtained, and the preliminary work is well in hand. At the same time, owing to the conditions, considerable delays are anticipated in completion.

The power house is being arranged for an ultimate plant capacity of 160,000 kw., and the first section will accommodate 30,000 kw. Purified sewage effluent is to be used for condensing purposes, this expedient having been forced upon the Electricity Department by reason of the refusal of the Manchester Ship Canal authorities to consent to the canal water being used. The preliminary plans of the generating station show it to be essentially a big unit station. It is proposed to erect it in four sections, each of which will contain two complete steam raising, electrical generating, and auxiliary plants, there thus being eight complete plants in the station. This will allow of one spare plant, one set for repairs, and six in commission. The first four generating sets will each have a capacity of 15,000 kw., the remaining four each being rated at 25,000 kw.

Provision is made for four boiler houses, each with two batteries of water-tube boilers facing a central firing floor, with four coal silos. There will be one battery of boilers to each generating set, or one boiler house for every two turbines. The preliminary estimates show that 500,000 tons of coal per annum will be required by the complete plant, coal being brought both by the Bridgwater Canal and the Lancashire and Yorkshire Railway. The coal silos will hold two months' supply of fuel outside the boiler houses, there being at the same time thirty-six hours' bunker capacity in the boiler houses. The suction system for the removal of ashes is proposed. The first section will contain eight boilers, each with a normal capacity of 50,000 lbs. of steam per hour, and a maximum capacity of 60,000 lbs. per hour. Each boiler will be complete with its own superheater, economiser, and induced draught plant. As regards the proportion of boiler-heating surface to grate area provided, attention was called to the higher proportion in the States and on the Continent, compared with this country, it being pointed out that at the Detroit power house the proportion is 60 to 1; at the Fisk Street station of the Chicago Edison Co. it is 44 to 1; whereas in the new Barton power house it will be 35 to 1. The coal silos have one novel feature, viz., the provision of three-armed distributors, through which the silos are filled, instead of one shoot. The object is to assist in keeping the level of the coal across the silo more or less even and so reduce the labour required for trimming.

The first generating sets will be two 15,000 kw. turbo-alternators, three phase, 6,600 volts, 50 cycles, running at 1,500 r.p.m., and developing the normal output at 0.85 power factor. Turbine progress in this country, said Mr. Pearce, certainly seemed to be overshadowed by the developments in the States, where the General Electric Co. of Schenectady is building a 30,000 kw. machine for the Commonwealth Co. of Chicago, and a 35,000 kw. set for Philadelphia, whilst 50,000 kw. sets had been designed for the New York Edison Co. The most surprising thing about the new Manchester turbines, however, was the increased speed, the blade velocity amounting to 700 ft. per second. The steam consumption was calculated to be about 11 lbs. per kw.-hour. Wet air filters will be used in connection with the ventilation of the generators.

An unusual feature in design will be the design of the pump hall, in which all boiler and feed pumps, hot well and reserve feed water tanks will be placed, in addition to the apparatus for testing the steam consumption, &c.

At the north-western end of the station will be a sub-station for supplying the current required in the station, and there will also be a 3,000 ampere-hour battery for general continuous-current supply and excitation.

Between each pair of turbines there will be an open well containing the condenser and auxiliary plant, and between the first turbine and the sub-station there will be a rail track connecting with the general workshop forming a continuation of the switch-house.

For the sewage effluent for condensing-water purposes, a pumping station will be built at Davyhulme, from whence the purified effluent will be pumped to Barton. The discharge from

Barton back to Davyhulme will take place at a substantially higher level than the intake. Owing to this increase, the capacity of the sewage works will be automatically enlarged and the discharge effluent will have a temperature some 15° or 20° higher than the intake. This, again, will result in advantage to the Rivers Committee, for the consulting chemist to that body states he will be able to effect economies in the subsequent purification processes by reason of the higher temperature.

The main cables from the generators will run direct to step-up transformers, transmission taking place at 33,000 volts. The switchgear will be of the oil-immersed remote-control type, operated from a control gallery overlooking the engine-room.

Estimates of total costs give a figure of £1,775,000, this amounting to £11.09 per kw. of rated load and £8.8 per kw. of overload. These figures compare with £12.26 and £9.81 for the London County Council power scheme, in which a total capital expenditure of £1,471,260 was contemplated. Works costs are put at 0.138d. per unit on a 40 per cent. station load factor. To this is added 0.88d. per unit for capital charges, making a total of 0.226d. per unit, apart from administration expenses, compared with 0.353d. at the Stuart Street station of the Corporation at present. The difference on the present output would amount to £60,000 per annum.

The papers of electrical interest referred to below were also read before the Section on Friday. Several others relating to wireless telegraphy are dealt with on another page of this issue under "Telephony and Telegraphy."

Heating of Iron by High-frequency Magnetisation.

A paper by Mr. N. W. McLachlan described experiments illustrating the heat produced when iron is magnetised by alternating currents, with frequencies of the order of $2 \text{ to } 5 \times 10^3$ cycles per second. The magnetising current was obtained by a Poulsen-arc generator connected across 240 volts D.C. In order to demonstrate the extent of the losses, a magnetic heater or boiler, consisting of a solenoid wound on a glass tube containing water and a number of iron strips or wires, was inserted in the shunt circuit of the generator. A short time after the shunt circuit was closed the water began to boil. An experiment was also arranged to show the variation in permeability of iron with variation in temperature. A ring of Lohys (mild steel), insulated with asbestos and wound with a number of turns of copper wire, was connected in the shunt circuit of the generator. By passing a large current through the winding of the ring, thereby obtaining a strong magnetising force, the magnetisation losses were such that a rapid rise in temperature was produced, causing the iron to attain a bright red heat. The variation in permeability corresponding to the rise in temperature may be followed by observing the current in the shunt circuit and the voltage across the terminals of the ring. Data, including the watts lost per kg., are given, which enable the changes to be followed. For example, let a frequency of 1.9×10^3 with $B_{max} = 3,500$, the watts lost per kg. worked out at 48,000.

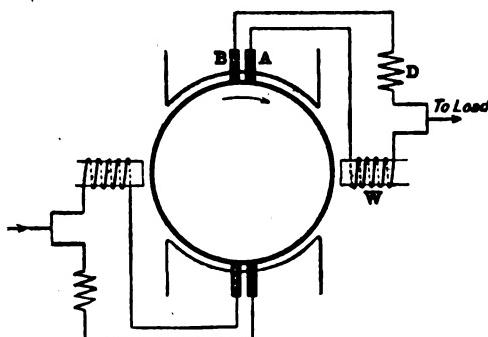
In the discussion which followed, Prof. E. W. Marchant (Liverpool) said that the important fact which emerged from these results was that the quality of iron with varying temperature was evidently very much the same as it was at ordinary low frequencies. It was found, however, almost impossible to calculate the true permeability of the material because of the enormous skin effect which led to surprisingly high power factors of coils with iron cores at very high frequencies. Prof. Gisbert Kapp said that the difficulty was in a machine which contained iron to work with a frequency of 200,000 or 250,000 without having an enormous loss of power due to hysteresis and skin effect. Experiments in wireless showed that the ordinary laws did not hold good, and the problem was to determine how the loss increased with the frequency.

A Self-adjusting Commutating Device.

A paper with this title was then read by Prof. Miles Walker. He pointed out that a continuous current generator with commutating poles will not commute very heavy over-loads, owing to magnetic saturation of the inter-poles interfering with the proportionality between the current commutated and the commutating flux. The paper described a device tried at the Manchester School of Technology which automatically produces the right amount of commutating flux over very wide ranges of load. Each brush consists of two parts, one part, A, being slightly in advance of the other on the commutator, and lightly insulated from it. The winding on the commutating pole has twice as many turns as it would ordinarily have, and the cross-section of the copper conductor is only sufficient to carry one-half of

the armature current. The part of the brush B may be connected through a diverter D, having the same resistance as the winding W, or the diverter may be dispensed with altogether. The direction of rotation of the machine is such that a point on the commutator passes first under B, then under A.

Assuming that the number of turns on the commutating pole is such as to give the right commutating flux when half current is passing through them, then it will be found that the current will divide evenly between brushes A and B, because the correct excitation of the commutating pole gives



A SELF-ADJUSTING COMMUTATING DEVICE.

an even distribution of current over the face of the compound brush AB. If, however, the number of turns in W is too great, there is a tendency to over-commutation; that is to say, the current in B becomes greater and the current in A less. This has the effect of automatically weakening the commutating pole, which remains of just such a strength as to bring about the required distribution of current between A and B. If for any reason the commutating pole tends to become too weak, owing, let us say, to the saturation of the iron of the pole, the induction of the armature coils carries the current forward to brush A, and tends to increase automatically the excitation of the commutating pole.

In the discussion Mr. G. G. Stoney, F.R.S., said that having a double brush would probably make it possible to increase the brush area. It was one of the bugbears of the designers of turbo-generators to get sufficient area on the brushes. He asked whether, in the case of a machine with both commutating poles and compensating windings, the author's device would supply the current to both. Narrow brushes, in his experience, ran better than wide ones. Mr. McCall thought that the method might be carried still further to get higher connecting voltages to deal with temporary overloads.

Prof. Miles Walker, replying, said the apparatus had not yet been tried for D.C. turbo-generators, and pointed out that these were not now made except in small sizes. It would be possible to connect the apparatus so that the current from the forward brush went through the compensating winding as well as the commutating pole. In a continuous-current generator it was necessary to put enough turns on the commutating pole to compensate for the armature, and that was a distinct advantage in connection with this apparatus, because the very slightest change in the proportionality of the current between the two brushes gave the effect required. He did not think that the increase in the proportion of the commutating current advocated by Mr. McCall was necessary.

Transformer Core Losses and Triple Harmonics.

Experiments on the effect of triple frequency harmonics on core losses in transformers were described in another Paper read the same day before Section G by Messrs. H. M. Lacey and C. H. Stubbings. An alternator giving approximately a sine wave was three-phase star connected to a three-phase choking coil. The star centres were also connected through a switch, and experiments were made with this switch open and closed. In each case the wave forms of phase amperes, phase volts, and in the second case amperes in the neutral wire, were taken by means of a Kelvin quadrant electrometer and a contact-maker. It was found upon analysing the various wave forms that in the first case there was a 48·9 per cent. triple harmonic in the volt curve but practically none in the current curve. In the second case there was practically no triple harmonic in the volt curve, but 48·2 per cent. in the current curve; also the wave of current in the neutral wire was very nearly a sine wave of triple frequency, and having an amplitude of approximately three times that of the triple harmonic in the current curve. This shows that the existence of a neutral connection enables a triple harmonic to exist in the current curve, and also that the suppression of this harmonic from the current curve forces it into the volt curve. Using these curves, the induction curves for the two cases were drawn, and from these the hysteresis loops (including eddy current losses) were obtained. The areas of the two loops were measured, and the ratio of the areas

case 1 : case 2 was found to be 0·775, thus showing that by insulating the star centres a saving of 22·5 per cent. in the core loss is obtained, the voltages being equal. The watts supplied in the first case were 24·3 per cent. less than in the second case, the average watts being found from the curves. The results of these experiments point to the fact that from the point of view of core losses the star centres in three-phase systems should be insulated.

Exposure Tests of Aluminium Alloys.

Prof. Ernest Wilson, in a Paper read at the same meeting, described the results of exposure tests of wires of various materials left exposed to the London atmosphere on the roof of King's College during the last fourteen years. Commercial aluminium increased its electrical resistance by 17·2 per cent. in thirteen years. The copper-aluminium alloys became so corroded as to be useless; a copper-manganese alloy had increased its resistance about 10 per cent. in thirteen years; and copper-manganese-magnesium (duralium) alloys 9·6 per cent. in four years, but had become brittle. Copper-nickel and copper-zinc-nickel alloys had somewhat increased their resistance.

Mutual Induction between Masses.—Among the Papers before Section G on Saturday was one by Prof. Miles Walker, describing some curious experiments to determine, in view of the closeness of the analogy in the behaviour of matter in motion and electricity flowing in a circuit, whether there is any action between masses analogous to the mutual induction between electric circuits—that is, if we accelerate a fly-wheel whether it produces any force upon an adjacent co-axial disc. No such force of measurable magnitude was detected.

A Cadmium Vapour Arc Lamp.—Before Section B (Chemistry) on the Wednesday, Dr. H. J. S. Sand exhibited a cadmium vapour arc lamp, the use of which is recommended for polarimetric and other purposes, is comparable in general principle with the well-known mercury vapour lamp. The lamp is constructed of quartz-glass, and the cadmium is freed from oxide and dissolved gas by a process of filtration while at the pump. It is hindered from adhering to the glass by the presence of a small amount of a loose powder (zirconia) in the lamp. The metal is melted by external heating before starting, and maintains itself in the molten condition by the heat of the current. Once started the lamp may be kept burning for an indefinite time.

It has been decided to hold next year's meeting at Newcastle-on-Tyne under the Presidency of Sir Arthur J. Evans, and the 1917 meeting at Bournemouth.

EMPLOYMENT OF WOMEN IN THE ELECTRICAL INDUSTRY

THE draft interim report of a Committee appointed by the British Association to investigate the question of women labour both before and after the war, dealing with the electrical apparatus industry (presented to Section F, Economics), gave the following figures of men and women employed in the electrical industry for 1911:—Electric cable manufacture, 4,858 men and 955 women; electric lamp manufacture, 5,627 men and 4,202 women; other electrical apparatus and electrical fittings, 50,341 men and 4,118 women. The total number of women is thus 9,275, which compares with a total of 2,490 given for 1901. The report goes on to state that women are to some slight extent doing work which before the war was done by men, such as small lathe work, screw machine, cable-making, winding of transformers and armatures. This last may be regarded as an extension of work previously done by women. Before the war, women were definitely employed in all branches of light work in electrical apparatus work, but not at all in the electrical supply trade. Although the above displacement is classed as owing to the war, there is evidence that before August, 1914, the policy of many firms had been to extend the employment of women into new branches. That women have to some extent been replacing men, or entering new branches, may also be inferred from the fact that, though the electric lamp branch of the trade has been depressed owing to the war, there has been a total increase in the employment of women in the electrical trade of nearly 18 per cent. Part of this increase is due to a temporary increase of production in branches of the trade in which women were previously employed, but as the enlistment of men from this trade has been on a considerable scale, it is reasonably clear that women are to some extent taking their place during the emergency. In most cases readjustment to meet the introduction of women has been simple, or no alterations at all have been necessary. One firm has actually made the machines more mechanical and employs an extra mechanic as supervisor. The introduction of women into new processes often necessitates the provision of another workshop, as in the majority of cases it is not considered desirable for men and women to work together.

The main objections to the employment of women are given as want of technical skill and general experience, want of physical strength, objection on the part of employers to have men and women working side by side, men's objection to the introduction of women. In regard to the question of physical strength, one firm employing women in lathe-making found

the women's output slightly less than that of men, owing mainly to exhaustion during the last hour of work. Nevertheless, it is clear that as a general rule women's output is considerably less than that of men, since both on time and piece rates their wages are generally 50 per cent. below those of men. The main advantages are:—Their greater dexterity in certain processes where small fingers are an advantage. This has been a considerable factor in the employment of women in such processes as assembly work in the electric lamp trade. Cheapness of their labour. The larger supply of unskilled workers to draw upon.

In those processes which are suitable to women, continues the report, the possibilities of extending their employment are great. In the more skilled processes, however, where a longer training is necessary, it depends how far women choose to utilise the present opportunity of becoming highly efficient workers. Hitherto women have been employed almost entirely in unskilled processes, and the trade has been essentially one for young persons, the majority of the girls leaving the trade soon after the age of nineteen. It is difficult to foretell the state of trade after the war, but in view of the accumulation of private work which cannot be done at present, employers rely on its being good for at least a year or two, and they therefore expect to absorb the men returning from the Front as well as the new women that have been taken on.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,460.

I have a 100 volt 50 ~ small table fan (series wound) which will not run on a 105 volt 83 ~ current. Is this due to the difference of the currents, or is there a fault in the fan? A current passes, causing the fan to hum. What is the general effect of a change of voltage and change of periodicity on such a motor? Should a similar 100 volt D.C. motor run on 100 volt 50 ~ A.C. circuit?—K. E. N.

(Replies must be received not later than first post, Thursday, September 23rd.)

ANSWERS TO No. 1,458.

I am attending to a continuous-current electric crane designed to lift 30 tons. The figures on the name-plate of the hoisting motor (which is series wound for 400 volts) are worn off. I should be glad to know what its rated horse-power and its normal and overload current is likely to be.—(H. T.)

[A lifting speed agreeing with usual practice may be assumed.—ED., E.E.]

The first award (10s.) is given to W. H. for the following reply:—

The brake horse-power of the hoisting motor of a 30-ton crane is practically dependent on the hoisting speed. Older practice usually gives a hoisting speed of about 6 ft. per minute maximum when lifting the full 30 tons. More modern practice results in considerably higher hoisting speeds, usually about 9 or 10 ft. per minute, while for special cranes in steel works, &c., the lifting speed may be as high as 15 ft. per minute. The average efficiency overall of the gearing and ropes would be in the neighbourhood of 64 per cent. We have now all the necessary information to determine the brake horse-power of the hoisting motor. This will be given by the formula:—

$$\text{B.H.P.} = \frac{\text{lbs. hoisted} \times \text{speed of lift in ft. per min.}}{\text{Efficiency} \times 33,000}$$

$$= \frac{30 \times 2,240 \times 10}{0.64 \times 33,000} = 32.$$

This gives the brake horse-power required for a hoisting speed of 10 ft. per minute. For other hoisting speeds the horse-power may be obtained from Fig. 1.

Ordinary crane motors are usually what is known as "half-hour" rated, i.e., they will develop their full load output for a period of half an hour without exceeding certain specified temperature rises, generally 40° C. or 50° C. Another way of

rating is to say the machines will develop their full load for two minutes in every ten minutes or some equivalent rating.

A well-designed crane motor should have a maximum overload capacity of 100 per cent. in current. In this case the voltage

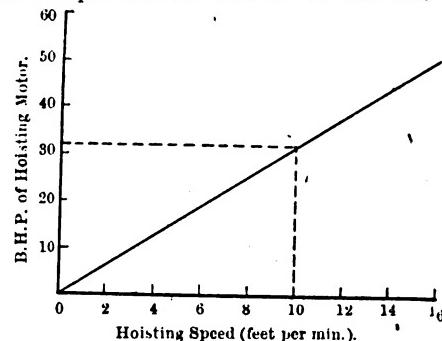


FIG. 1.—HORSE-POWER REQUIRED.

being 400 v., the normal current would be 68 amperes, corresponding to an output of 32 B.H.P. The maximum current would therefore be 136 amperes, and this for a series-wound motor would correspond to a torque of about 2½ times full load

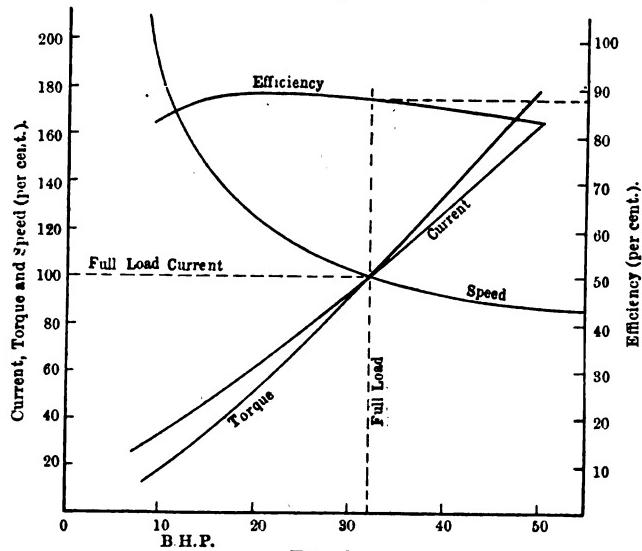


FIG. 2.

torque. This current could only be sustained for a very short time, say a few seconds.

For convenience Fig. 2 has been plotted, showing representative curves giving current, torque, speed, and efficiency as percentages of normal full load values for a 32 B.H.P. motor.

The second award (5s.) is given to "Alpha," who writes as follows:—

The rating of the hoisting motor of a crane is given by:—

$$\text{Tons lifted} \times 2,240 \times \text{ft. per minute}$$

$$\text{H.P.} = \frac{33,000 \times E}{15 \times 746}$$

where E is the efficiency of the gearing. As the crane in question is apparently an old one, the lifting speed is not likely to be high, and may be assumed to be 5 ft. per minute. Allowing about 70 per cent. for the efficiency of the gear, a 15-h.p. motor is required, and this is quite a likely figure for the lifting motor of a 30-ton three-motor crane. It would be an easy matter for H.T. to check the lifting speed, but this should be done when lifting approximately full load, as the speed of a series-wound motor varies greatly with the load.

Allowing for a motor efficiency of 80 per cent., the full load current of a 15-h.p. 400-volt motor will be $\frac{15 \times 746}{400 \times 0.8} = 35$ amps.

The motor will probably have been built for a half-hour or one-hour rating, with a permissible overload of 100 per cent. momentarily, or, say, 75 amps., allowing for the drop in efficiency on overload. If the hoisting speed is more than 5 ft. per minute, the above values of horse-power and current should be increased in proportion. It may be mentioned that it is common practice for the longitudinal travel motor of a three-motor crane to be a duplicate of the hoisting motor, though this is not invariably the case. It would be easy to determine whether they were the same size in this case, and if so the name-plate of the travel motor would, if readable, afford a check on the calculated power of the hoist motor. Alternatively, an ammeter might be temporarily connected in to measure the current when lifting 30 tons. It should be noted that a test at, say, half-load (15 tons) would give more than half the full load amps., since the hoisting speed would be higher than at full load, and the losses in the gearing would also be more than half the full load losses.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 9th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

252/14. Wireless Relays. G. VON AROO and A. MEISSNER. A relay for A.C. particularly suitable for wireless telegraphy and telephony, employing a bulb containing an ionised gas path in which the current, strengthened by the relay, is led with unchanged frequency directly or indirectly to the primary circuit of the relay again, so that the whole of the current or a part thereof repeatedly passes through the relay and is further strengthened. (Six figures.)

18,887/14. A.C. Motors. F. C. CREEDY. A variable-pole machine in which the number of poles is changed by altering the phase difference between zones or bands of current of fixed position. The method of phase variation consists in the use of a polyphase supply of such phase number, preferably prime to all the number of pole pairs, as to permit of the phase difference between adjacent zones supplied from different phases on n pole pairs being made n times the phase difference for one pole pair. (25 figures.)

20,959/14. H.T. Windings. W. H. WILSON and F. W. WRIGHT. A method of constructing high-tension windings from flat ribbon conductors wound in conical layers separated by insulating fabric. (Three figures.)

21,389/14. X-Ray Tubes. B.T.-H. Co. (G.E. Co., U.S.A.). Tubes in which overheating of the target is prevented by making the target revolve by magnetic means in order continually to present a fresh surface.

21,798/14. Locking Lampholders. C. G. M. BENNETT and C. H. JEFFCOAT. The cap of the lampholder is provided with a recess adapted to receive the screwed end of a locking pin, which is screwed into engagement with the top of the cap of the lamp to prevent it being pushed in to disengage. (Four figures.) [See ELECTRICAL ENGINEERING, Feb. 11th, p. 62.]

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. Co. (G.E. Co., U.S.A.) [Distribution systems] 18,971/14.

DYNAMOS, MOTORS, AND TRANSFORMERS: SIGNAL GES. [Submersible motors] 7,821/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Cooling of dynamos] 21,825/14.

Heating and Cooking: BERRY [Heating apparatus] 17,328 and

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Before Section G (Engineering) of the British Association Meeting in Manchester on Friday, three Papers relating to wireless telegraphy were read.

Oscillations in Coupled Circuits.

The first Paper on the above subject was by Dr. W. Eccles and Mr. A. J. Makower. In this Paper mathematical investigations are detailed into the properties of circuits coupled both electrically and magnetically in a variety of ways that might give rise to single-frequency oscillations. The calculations are carried out in terms of the inductances and capacities of the circuits rather than in terms of the coupling coefficients. Although in some cases both methods of notation lead to the same results with equal ease, there are others in which the definition of the coupling coefficient becomes a matter of some difficulty. It was generally agreed that the Paper was too mathematical to be discussed in the usual way. Prof. G. W. O. Howe, who has done some work on the same lines, made a few comments, and Prof. E. W. Marchant said that the formulæ given would be of great value to the designers of wireless telegraphy stations.

Capacity of Aerials.

Prof. G. W. O. Howe then read a Paper on the capacity of aerials of the umbrella type. In a previous Paper he had

17,329/14; B.T.-H. Co. (G.E. Co., U.S.A.) [Electric heating for metal working] 19,942/14.

Ignition: KELLER DORIAN [Magnetas] 23,628/14; KING [Spark-plug tester] 24,428/14.

Storage Batteries: FULLER, FULLER, and FULLER [Accumulators] 23,182/14.

Switchgear, Fuses, and Fittings: PERRY [Conduit joints] 19,121/14; NYBORG [Switches] 19,290/14; IGRANIC ELECTRIC CO. (Cutter Hammer Mfg. Co.) [Controllers] 3,284/14; R. BOSCH [Switches] 8,180/14.

Telephony and Telegraphy: MUSSO [Transmission of impulses over circuits of high capacity] 17,246/14; JUDD, DAVIES, and EASTERN TELEGRAPH CO. [Telegraphy] 19,483/14.

Traction: THOMPSON [Communication with trains] 19,123/14; STORJOHANN [Track brakes] 19,238/14; CUMMING [Points, &c.] 21,575/14.

Miscellaneous: OESTERREICHISCHE SIEMENS-SCHUCKERTWERKE and REGAL PATENTE GES. [Electric jacquard card-punching machines] 12,673/14; GRAHAM and RICKETS [Order signals] 58/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Electrochemistry: NELSON [Electrolysis] 10,604 and 10,605/15.

Telegraphy: RAINES [Multiplex wiring] 10,983/15.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

18,652/01. Blow-out Coils. T. VON ZWEIGBERGK. An improved form of magnetic blow-out attachment for controllers consisting essentially of an electromagnet enclosed by a metallic shield, against the exterior surface of which the arc is blown.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS AND TRANSFORMERS: B.T.-H. Co. (G.E. Co., U.S.A.) [Control of single-phase motors] 11,930/04; A.E.G. [Control of single-phase motors] 12,090/07; F. KLINGELFUSS [Testing transformers] 11,299/08.

Electrochemistry and Electrometallurgy: S. COWPER-COLES [Electrodes] 12,469/09.

Heating and Cooking: A. F. BERRY [Inductive heating apparatus] 12,333/06; M. HANKIN [Heating resistances] 11,128/08.

Telephony and Telegraphy: F. RITCHIE [Telautographs] 11,957/06.

Traction: W. J. WILGUS and F. J. SPRAGUE [Underrunning contact rails] 12,344/06.

Miscellaneous: W. PATTERSON and C. DARAH [Electric relighting of miners' lamps] 12,144/02; W. D. WHYTE [Magnetic compasses] 11,807/04; P. H. THOMAS [Vapour electric apparatus] 10,653/05.

developed a method of calculating the capacity of antennæ. The umbrella type, however, was not specially considered, and curves and formulæ are now given for this type. The whole aerial is assumed to have a uniformly distributed charge, and the average potential of the whole aerial under this fictitious condition is then calculated. It is assumed that if the total charge, while remaining unchanged in quantity, be allowed to have its own natural distribution, it will assume a uniform potential approximately equal to this fictitious average potential. The proximity of the earth is taken into account by the method of images. Tables and curves are given for aerials with from two to six ribs and for various angles between the ribs and the vertical. With these curves and those given in the original Paper, each of the nine component potentials of any given aerial of the umbrella type can be read off and the resultant average potential determined. The method is then applied to two practical examples, one a simple aerial with six single-wire ribs and the other a more complicated case in which each of the five ribs consists of a four-wire cage, the size of the wire being different from that used for the central vertical wire.

Earth Resistance.

The final Paper of the series was a note on "earth resistance," by Prof. E. W. Marchant. This Paper described a new method of expressing the effectiveness of earthing arrangements such as are employed for lightning-conductors, radio-telegraphic stations, and in connection with many electric power distributing systems. The method consists in determining the length of the column of earthy material which, with a cross-section equal to the surface of the earth-plates, would have the same resistance as the actual "earth." For a hemisphere embedded with its flat surface level with the surface of the ground, this

"equivalent length of earth" is easily seen to be equal to the radius of the hemisphere. Some tests were described, made by the author at Liverpool on three "earths" of different types, one being the water-pipe system of the building. Prof. G. W. O. Howe, in the discussion, said he had also done some work in this connection, and the results, which would be published shortly, indicated that Prof. Marchant's measured results were absolutely at the mercy of the specific resistance. Dr. W. H. Eccles said that in the calculation or measurement of earth resistance in wireless telegraphy, it was necessary to be specially careful to remember that the effective resistance varied with the frequency. It varied by as much as 300 or 400 per cent. Mr. J. Frith asked how Prof. Marchant measured his earth's resistance. Continuous-current was not reliable, and A.C. with a bridge and telephone was the best method. Prof. Kapp remarked that even with A.C. there was such an effect as contact resistance between the plate and the earth. The first quarter-inch contact between the plate and earth must have a different resistance to the middle of the plate and earth. Had that fact been observed and accounted for? Prof. Marchant, replying, said the main object he had in mind was to attempt to establish some sort of a standard by which the effectiveness of different forms of earth-plate could be measured. As to Dr. Eccles's point, he understood that the form of earth-plate did not make much difference. Dr. Eccles interposed that the form of earth-plate did not matter so long as it contained one-half or one-third the copper in the antenna. Prof. Marchant, continuing, in reply to Mr. Frith, said he measured with direct current. It was rather difficult to answer Prof. Kapp's point with regard to contact resistance. The results seemed to show that the main factor in the measurements was the resistance of the material.

The Research Committee.

The report of the Radiotelegraphic Investigation Committee was presented to Section A (Mathematical and Physical Science), and states that work of collection of statistical data was discontinued at the outbreak of the war after the work had been going on for only three weeks. The special observations in connection with the solar eclipse were likewise almost entirely abandoned. Some general conclusions are drawn from the few weeks' observations that were made. With regard to diurnal variations, it was seen that the strays heard in the dark hours are much more numerous and louder than those heard during daylight. Unless local weather conditions are producing great disturbance, the change from night to day conditions, and vice versa, in stations north of the equator lags behind the sunrise and sunset. The strays are more serious, especially in the daytime, in the tropics than the temperate latitudes. Excessive disturbances or "X storms" usually occur within the same two or three days over very wide areas. Occasionally they are reported simultaneously hundreds of miles apart, but more usually are separated by several hours. Periods of severe strays coincide with low and rapidly varying barometers, high wind, rapid change of temperature, and rain, and are often associated with thunderstorms not far distant. The period of greatest disturbance in the Mediterranean is September and October, the months of cyclonic weather. There appears to be two kinds of X storms occurring in the daytime, those produced by convective conditions in the atmosphere within a hundred miles of the station and those originating at a distance. No connection between strays and auroral displays has yet been traced, nor have the observations made so far revealed the 27-day period of magnetic variations.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Wakefield.—A loan of £1,000 is to be applied for to provide an additional boiler-feed pump and cooling tower.

Worcester.—An expenditure of £250 is contemplated on mains to supply the Severn Bank Tannery.

Wiring

Weston-Super-Mare.—Free Library. Town Clerk.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Lincoln.—Labour Exchange. H.M. Office of Works, Storey's Gate, London.

Nottingham.—Two large factories. Town Clerk.

Miscellaneous

Burton-on-Trent.—At a L.G.B. inquiry last week concerning powers to run omnibuses by the Corporation, the Borough Electrical Engineer said he favoured electric omni-

buses. He estimated the expenditure upon one bus at £1,200 against £6,000 per mile in the case of tramways. He put a life of ten years upon the vehicle, and added that whereas in one town he knew of the cost of petrol for one car annually was £500, the cost of electricity for a similar service would only be £365.

Edinburgh.—Six months' supply of electrical fittings for the Midlothian and Peebles District Asylum, Rosslynlee. Clerk, 19 Heriot Row.

Liverpool.—Six months' supply of electrical stores for the West Derby Union. Clerk, Brougham Terrace.

London: *Bombay Railway Co.*—Lamps and lamp fittings. Secretary, 110 Bishopsgate, E.C. Sept. 21st.

H.M. Office of Works.—Tenders are required for the repair of incandescent electric lamps. H.M. Office of Works, Storey's Gate, S.W. Oct. 1st. (See advertisement on another page.)

Manchester.—Electric lamps for the Guardians. Clerk, Guardians' Offices, All Saints'. Sept. 21st.

Merthyr Tydfil.—Six months' supply of electrical accessories for the Guardians. Clerk, 134 High Street.

Wolverhampton.—Six months' supply of electrical fittings for the Union. Clerk, Poor Law Offices. Sept. 21st.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London: *G.P.O.*—The tender of Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of Wotan lamps during the next six months. The Postmaster-General has placed a contract for Royal Ediswan Drawn Wire Lamps.

The General Electric Co., Ltd., advises us that it has, for the seventh time, received the sixth monthly contract from the General Post Office for the supply of Osram Drawn Wire Lamps. The Company has also received contracts for the supply of many thousands of Osram and Robertson lamps to the Admiralty and the War Office.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. C. White, of the St. Helen's Cable & Rubber Co., Warrington, was operated on last week for appendicitis, but is now progressing satisfactorily. He is particularly identified with the design of the company's corrosion-proof cable fittings.

Consequent upon the resignation of Mr. A. E. Wilson, the Bristol Deputy City Electrical Engineer, on his appointment to the position of Electrical Engineer to the Chief Engineer of the Southern Command, Mr. A. J. Newman, who has been in the Department for eleven years, is to be promoted to succeed Mr. Wilson. The salary will be £350, rising to £400 per annum. Mr. A. J. Ostler is to be promoted to Sub-station Engineer at £200, rising to £250 per annum, and Mr. I. A. D. Pedler is to be promoted to Mains Engineer at £175, rising to £250 per annum. The Electricity Committee also propose to appoint a boiler-house superintendent, in order to bring about further economies in steam raising, at a salary of £200 per annum.

Mr. J. F. Murdock, of the Lancashire Electric Power Co., has been appointed Borough Electrical Engineer at Bacup.

H.M. Dockyard, Rosyth, require good jointers for work chiefly in H.M. ships. See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £84 to £85 (last week £82 to £83).

Advance of Prices.—The General Electric Co., Ltd., an-

nounce an advance of 25 per cent. on the prices of conduit accessories and 10 per cent. on girder clips. Special prices will be quoted on application for casing and capping, zinc bell tubing, and galvanised material.

Electro Galvanising.—The Cowper-Coles Galvanising Co., 1 French Street, Sunbury-on-Thames, have erected a special plant for the rapid galvanising of nails and small steel and iron articles generally. They claim that a particularly even distribution of zinc is obtained.

Bankruptcy.—At the public examination of Herbert Page, Electrical Engineer, 63 Queen Victoria Street, E.C., the statement of affairs showed gross liabilities amounting to £2,278 and net assets of only £90. The debtor has been in business with a partner under the style of Smeeton & Page, with a capital of £150, but in 1904 the partnership was dissolved, and he took over the assets and liabilities. In 1907 an arrangement was made with his creditors by which 3s. 6d. in the £1 on liabilities amounting to £1,500 was paid, but in 1912 a further shortness of capital necessitated additional borrowings, and being pressed by creditors has been obliged to file his petition. The matter remains in the hands of the Official Receiver.

LOCAL NOTES

Aberdeen: *Position of Electricity Undertaking.*—In presenting the annual accounts for 1914-15 at the last meeting of the Corporation, the Convenor of the Electricity Committee said that the war has had a considerable effect upon the electrical undertaking in many ways. Fifty-seven per cent. of the men employed between 18 and 40 had joined the forces, and the shutting-down of practically all public lighting, together with the curtailing of shop-window lighting, had resulted in a drop of £3,800 in revenue. The units sold were 800,000 more than in the previous year, whilst the total working expenses were reduced by £1,027 as the result of their new generating plant and the better load factor. The large increase in the power units and the profit from them he contended justified the Committee's policy as against the critics who argued that the power tariff in Aberdeen would lead the Department to financial trouble.

Dublin: *Wiremen's Strike.*—The Dublin wiremen came out on strike on Saturday in connection with their demand for an increase of wages from 9½d. to 11d. The employers point out that this, on a normal week's work, will represent an increase of 7s. 6d. per week, and that contracts will not stand such an increase. On the other hand, the men point to the increase in the cost of living, and seem to hope that the shortness of men will also assist their cause. None of the Corporation employees, however, are affected.

Dundalk: *Power Station Extension.*—At the last meeting of the Urban Council it was reported by Mr. Spalding, the Electrical Engineer, that the new storage battery at the power station is nearing completion. The six new cells erected recently as an extension of the battery were permanently connected last week. The first of the two new Diesel engines is about to be received from the makers.

Edinburgh: *Coal Prices.*—It is stated that the Electricity Committee has had under consideration the question of giving notice to their coal contractors for a reduction in the price of coal in accordance with the terms of the recent Act of Parliament. It was decided to inform the coal contractors that the Committee expect their coal to be supplied at a price not exceeding 4s. per ton more than the corresponding prices last year.

Hove: *Increase in Electricity Charges.*—The Electricity Committee recommends that the charge for private house lighting be increased by 1d. per unit. Some objection has been taken, but the Committee is convinced that there is no alternative, having regard to the increase in the price of coal, wages, etc. The charge will now be 6½d. per unit.

At the time the Corporation took over the Hove Company there were anticipations of a decrease of 2d. per unit.

Ireland: *The Lough Erne Electricity Scheme.*—With regard to the scheme for utilising the falls of Lough Erne, of which we gave particulars in our issue for May 13th, p. 207, the *Times* last week stated that the Company which had the matter in hand will be seeking Parliamentary powers next session. It is also stated that the necessary capital has already been subscribed.

London: *St. Pancras: Allocation of Electricity Profits.*—The Electricity Committee has been considering the question of the disposal of the electricity profits for the year to March 31st, 1915. In the accounts recently presented to the Council, there was a balance of £6,413 in the net revenue account after retaining £4,000 as working balance, and the Electricity Committee now state that they have no hesitation in recommending that this sum of £6,413 should be allocated to relief of rates.

Wakefield: *Insurance against Aircraft.*—The Electricity Works are to be insured against damage by aircraft to the amount of £50,000. There was a loss of £336 on the past year's working of the electrical undertaking against a profit of £488 in the previous twelve months, and an increase in the charge for power and lighting of 2½ per cent. is to be made. This, however, will only bring the charges to the same as they were before April last.

Walsall: *The New Electricity Works.*—At the last meeting of the Council it was stated that the new electricity works will not be in operation this year as had been anticipated, and the Chairman of the Committee hoped that the public will economise in the use of electricity between 4 and 6 p.m. during the winter, this being the time of maximum demand.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Nairobi Electric Power & Lighting Co.—The directors in their annual report said that the schemes for the utilisation of the Thika Falls, forecasted in the last report and for which tenders were received and necessary financial arrangements made, had to be stopped owing to the outbreak of war. The Treasury prohibition of new capital issues being most stringently applied when it is a question of using the money outside the United Kingdom had also effectively stopped their schemes. Sanction, however, had been obtained for the issue of capital necessary to provide auxiliary steam plant at Nairobi to prevent the inconvenience which would arise by the complete stoppage of the developments of the Company's undertaking.

British Insulated & Helsby Cables.—An interim dividend of 5 per cent. is recommended on the ordinary shares, compared with 4 per cent. last year.

The Electric Vehicle.—The September number of the journal of the Electric Vehicle Committee contains several illustrations of vehicles which took part in the parade during the I.M.E.A. Convention and notes on Mr. Aytoun's Paper and the discussion on the same afternoon. Extracts are also given from a report of a Sheffield Sub-Committee in favour of electric vehicles for house-refuse collection. Other subjects treated are small industrial trucks, such as are rapidly coming into use for railway and warehouse work, and the electric taxi-cab service of Amsterdam. The list of electric vehicles in use or on order in Great Britain now reaches the total of well over 400. A supplement gives a useful series of notes issued by the Electric Vehicle Committee for the guidance of persons who wish to make arrangements for charging electric vehicle batteries. The most suitable methods to be adopted for all the usual voltages and systems of supply are set forth, and a specification of the equipment required for the actual charging board is given.

The British Westinghouse Employees' War Relief Fund.—From a statement of accounts of this fund, it appears that the total contributed to August 31st last amounted to £14,624 10s. 11d.; £10,134 has been contributed by the employees and £4,491 by the Company, and out of this sum £8,598 has been paid to dependants, £2,500 set aside for a Widows' and Orphans' Fund, over £1,200 has been spent in donations to outside funds, Christmas gifts, 1914, and payments to Red Cross workers. The number of families receiving relief is 621, and the number of employees who have joined the King's Forces 1,572. The very considerable amount of work involved in administering the funds has been performed by members of the Company's workmen and staff, voluntarily and without expense to the fund.



ELECTRICAL ENGINEERING

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SUMMARY

THE Engineering Standards Committee has issued a revised specification of electric supply meters (p. 386).

REVIEWS of technical books appear on page 386.

THE electrical equipment of the suburban lines of the London and South Western Railway is practically complete. An illustrated description of the power station at Wimbledon, the sub-stations, and the feeder system is given in this issue (p. 387).

A SMALL gas engine-driven station with some interesting details has been opened at Stowmarket (p. 388).

AMONG the subjects of specifications published at the Patent Office last Thursday are long distance telephony, conduit joints, cable telegraphy, and traction motor ventilation (p. 389).

A QUESTION relating to telephone installations in mines is propounded in our "Questions and Answers" columns (p. 389).

A PORTABLE X-ray apparatus and an electrical fire pump are described (p. 390).

NEW plant is to be installed at Sheffield (£100,000); and Aldershot (£6,194).—Cable is required at Swindon; generating plant at Pietermaritzburg (S.A.); and arrangements are to be made by the Islington Guardians for taking a supply from the Council (p. 391).

THE bulk of the electrical wiremen who came out on strike in Dublin have left the city for munitions work.—The Harrogate Borough Electrical Engineer

recommends a rateable value tariff with a secondary charge of 1d. per unit for 100 per cent. load factor apparatus.—The price of coal in Peterborough is now 21s. 4½d. per ton compared with 8s. 7d. a few years ago.—Complaint has been made in the Keighley Council at the policy of the Electricity Department in continuing to connect up new consumers (p. 392).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS FOR WEEK COMMENCING SEPTEMBER 27TH, 1915,
by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Drills, 6.30 to 7.30; 7.30 to 8.30.

Monday, September 27th: Section I., technical. Section III., squad, signalling class.

Tuesday, September 28th: Section II., technical. Section IV., shooting.

Thursday, September 30th: Section III., technical. Section I., shooting.

Friday, October 1st: Section IV., technical. Section II., squad, signalling class.

Saturday, October 2nd: Company parade, 2.30 p.m. Route march.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

A PROSPECTUS from the Manchester Municipal School of Technology gives full particulars of the part time courses which are held there in electric and other branches of Engineering for the benefit of those whose ordinary employment occupies the greater part of their time, in connection with a scheme of certificates and associateships. These courses commence on Sept. 27th, and intending students should be enrolled during the previous week. There are special courses in wireless telegraphy, Post Office work (telegraphy and telephony), wiring, electric traction, and instrument making. A full syllabus is contained in the prospectus.

A new prospectus containing the announcements for the session 1915-16 has been issued by the Northampton Polytechnic Institute (Clerkenwell). Full particulars are contained of the day and evening courses in electrical engineering and other subjects, which include special sections on wireless telegraphy and on electrochemistry. The classes for the day courses commence on October 4th, and the evening courses on September 27th. Enrolments have already commenced. In spite of the war, some additions have been made to the laboratory equipment, and practically all the courses are announced as usual, although certain special lectures have had to be abandoned.

Killed in Action.—We regret to announce that Second-Lieut. Raymond Lodge, of the South Lancashire Regiment, the youngest son of Sir Oliver Lodge, has died of wounds received whilst fighting in Flanders. Lieut. Lodge, who joined the Forces immediately on the outbreak of war, was connected with the firm of Lodge Bros., the electrical apparatus manufacturers, the partners in which were his elder brothers.

THE STANDARDISATION OF METERS

THE Engineering Standards Committee has now issued the revised edition of the British Standard Specification for Electricity Meters (excluding electrolytic meters). This is practically a new specification, as the committee found it necessary to redraft it entirely, and to extend it considerably in consequence of the large increase, during recent years, in the size of individual installations, arising from the extension of the use of electrical energy supplied from central stations. The first edition referred only to consumers' meters of sizes up to 100 amperes, but the revised report includes provision for meters up to the very largest sizes in use, as well as for three-wire and three-phase meters.

It is important to note that this specification is intended to apply to the purchase of new meters, governing their sale by the manufacturer to the purchaser, and has no direct bearing on any questions which may arise between the supply undertakers and their consumers in connection with such of the meters as are employed to register energy supplied from public supply mains. The requirements have, however, been so drawn up that meters conforming to them may reasonably be expected to fulfil the conditions imposed by the Board of Trade on meters used in connection with public supply undertakings, and to satisfy inspectors under the Electric Lighting Acts during a considerable period after the meters have been put into service.

Certain modifications and additions have been made to the standards and definitions, and the standard sizes of meters include sizes for currents up to 5,000 amperes. The registering mechanism is dealt with at some length, and the terms used to distinguish the different types of counting mechanism are "pointer type" for the ordinary clock-face with a rotating pointer and "counter type" for the so-called cyclometer mechanisms. In the latter case it is specified that the figures shall spring quickly into position, except the lowest figure used. The term "register" is used and defined as follows:—"The term register denotes the circular scales and pointers, or the figure openings and figure wheels, as the case may be, from which are read the figures that permit evaluation of the supply to the consumer."

The limits of error are specified in a table, the formula used in the first edition of this specification having been discarded. Up to 1·25 kw. the permissible limit of error is ± 2 per cent. from full load down to one-tenth load, and ± 5 per cent. at one-twentieth load. Above 1·25 kw. the figure is ± 2 per cent. in both cases. A variation of 10 per cent. above and below the marked pressure at any load down to one-tenth is not to cause a variation in accuracy of more than 1 per cent. Excess currents of 25 per cent. for half an hour and 30 times full load for half a second, and excess voltage up to 65 per cent., are not to impair the accuracy permanently.

Meters are required to have the testing constant plainly marked, and this constant is specified as the number of revolutions per minute which the rotor should make at the full load of the meter under standard temperature conditions. Clauses have been added dealing, amongst other things, with internal and external shunts and resistances; pressure and current transformers, and the marking of the terminals of three-phase meters. Appendices have been added dealing with the precautions to be taken in the erection of meters, and notes on the testing of meters. Illustrations of typical arrangements of meter registers have also been added.

The report, the price of which is 7s. 9d. post free, may be obtained direct from the offices of the Committee (28 Victoria Street, Westminster, S.W.), and is published for the Committee by Messrs. Crosby Lockwood & Son (7 Stationers' Hall Court, E.C.).

NEW PUBLICATIONS

"The Wireless Telegraphist's Pocket Book of Notes, Formulae, and Calculations." By J. A. Fleming, F.R.S. 347 pp. 7½ in. by 4½ in. 38 figures. (London : Wireless Press, Ltd.) 6s. net; abroad, 6s. 3d.

Standard Handbook for Electrical Engineers. Edited by F. F. Fowle. 1,984 pp. 6½ in. by 4½ in. 1,516 figures. (New York : McGraw-Hill Book Co.; London : Hill Publishing Co., Ltd.). Fourth edition. 21s. net.

"Russian Self-taught, with Phonetic Pronunciation." By Capt. C. A. Thimm and J. Marshall. 184 pp. 7½ in. by 4½ in. (London : E. Marlborough & Co.) Fifth edition. Paper covers, 2s.; by post, 2s. 2d.; cloth, 2s. 6d.; by post, 2s. 8d.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Wiring of Finished Buildings. By T. Croft. 275 pp. 8½ in. by 5½ in. 205 figures. (New York : McGraw-Hill Book Co.; London : Hill Publishing Co., Ltd.) 8s. 4d. net.

In the heavier branches of electrical engineering we know a great deal in this country about American practice. Many of our methods and apparatus are frankly based on American models, and the development of the electrical industry here has followed a course which has facilitated the blending of all that is best in British, American, and Continental ideas. In telephony the same applies to an even greater extent so far as American methods are concerned—in fact, in some cases, things that have been conceived here have awaited permanent adoption in Great Britain until they have been developed or re-invented on the other side of the Atlantic. House wiring, on the other hand, has been an exception, probably because it is particularly dependent on local conditions. That part of the subject which is based on Ohm's law is obviously more or less the same all the world over, but in the methods of erecting the wires and protecting them, the design and choice of fittings, and, last but not least, the methods of business-getting, British, American, and Continental practice are widely divergent.

The book before us brings this fact out clearly; in fact, it might have been written with the sole object of explaining to the Britisher the difference between British and American practice. The first part, the "Commercial Section," describes in detail the system in vogue in the United States for attracting new consumers to the mains. There, as here, it appears that the brunt of this falls upon the supply station. Wiring is let out to contractors, but it is the supply authority who has to undertake practically the whole of the business-getting. In this the main difference between American and British methods is the better appreciation in the former of the bargain-loving propensities of the public. Over there they have no L.G.B. audit, and they have also no Electrical Contractors' Association perpetually on the look-out to prevent the central stations from infringing their territory. Woe unto the municipal electricity department which could offer "to wire any residence kitchen or residence laundry for one double socket and furnish an electric iron and a lamp for \$12," payable in twelve monthly instalments; yet the Kansas City Electric Light Co., which did this, found that approximately half of the inquiries developed into contracts for wiring the entire house, and that practically every acceptance of the \$12 offer will lead to the whole building being ultimately wired. The second part of the book is the "technical section," and is equally interesting. It describes how house-wiring is done in America, and although, in many respects, British practice must always be different, the time spent in reading it will by no means be wasted.

The Motor Manual. 266 pp. 7½ in. by 5½ in. 298 figures. (London : Temple Press, Ltd.) Eighteenth edition. 1s. 6d. net; by post, 1s. 9d.

The succeeding editions of this hand-book on everything connected with the motor-car have always been kept well abreast of modern developments, and the revision shown in the eighteenth edition is as thorough as that of its predecessors. As electrical auxiliary services are more and more employed in automobilism, the space devoted to electrical matter has progressively increased, and now we find not only the latest developments in magneto ignition fully treated with the aid of admirable illustrations, but a quantity of new matter in connection with electric car lighting, engine starting, and combined systems for these purposes. The section on coil ignition has been retained in view of a possible revival of this system where batteries are already employed for other purposes, and the other portions of the work uphold the high reputation established in previous editions.

The Light Car Manual. 208 pp. 7½ in. by 5½ in., 161 figures. (London : Temple Press, Ltd.) Second edition. Paper covers, 1s. net; by post 1s. 3d. Cloth, 1s. 6d. net; by post, 1s. 9d.

Every subject of special importance to the light car owner is treated of in this little handbook, which is on the same lines as the well-known "Motor Manual" of the same publishers. Electric ignition is treated of in a clearly written chapter, and the applications of electricity to lighting, audible signals, &c., are also briefly dealt with. The note on the management of accumulators are particularly useful.

ELECTRIC TRACTION ON THE LONDON AND SOUTH WESTERN RAILWAY

We have referred on more than one occasion to the scheme of conversion to electric traction of the suburban lines of the London and South Western Railway, which involves practically all such lines within fifteen miles of Waterloo. The work is now nearing completion, and we are able, through the courtesy of Mr. H. Jones, the Company's Electrical Engineer, and the Consulting Engineers, Messrs. Kennedy & Donkin, to give some particulars of the equipment. The lines which are now being converted are the circular route from Waterloo via Wimbledon, Kingston, Twickenham, and Richmond and back to Waterloo, the Hounslow loop line, and the Hampton Court, Claygate, and Shepperton branches. The total length of these routes is about 47 miles, equivalent to about 140 miles of single track. At a later date a further system of about 50 miles of route, the equivalent of 100 miles of single track, may be undertaken. After a careful study by the engineers of the Railway of all systems in commercial use, it was decided to adopt direct current with a pressure of 600 volts on the third rail.

The Power House.

The power-house is at Durnsford Road, Wimbledon, centrally situated from the point of view of distribution, and with facilities for obtaining condensing water from the River Wandle. It also adjoins the railway, and coal can be tipped from trucks direct into the bunkers over the boiler-house—or on to a reserve storage space with a capacity of 10,000 tons. Another feature is the use of the vacuum system for ash-removal, so that there are no conveyors of the ordinary type in the station. A special viaduct, 500 ft. long, partly of ferro-concrete, connects with the railway.

The boiler-house, 287 ft. in length, runs parallel to the turbine-house, and contains at present 16 Babcock-Wilcox boilers, each with an evaporative capacity of 20,000 lbs. per hour, in two rows. They are fitted with chain-grate stokers and Green's economisers, and deliver steam at 200 lbs. per sq. in. with a superheat of 200° F. The two chimney shafts are 230 ft. high, built on the Custodis system, and are situated at the permanent end of the building. There are in the turbine-room five main and three auxiliary generating sets, with space for a sixth main set when required. The main sets are turbo-alternators of 5,000 kw. capacity running at 1,500 r.p.m., generating at 11,000 volts 3-phase 25 cycles. The turbines are of the impulse type, supplied by Dick, Kerr & Co., each provided with a separate surface condenser, supplied by Willans & Robinson, Ltd., in the basement. Each set embodies a direct connected exciter and motor-driven fan for ventilating the alternator. The three auxiliary sets are geared D.C. turbo-generators each having an output of 400 kw. at 220 volts at 5,000/575 r.p.m. These machines supply current for auxiliary power and lighting purposes. The turbines and gearing were supplied by C. A. Parsons & Co., but the auxiliary as well as the main generators were made by Dick, Kerr & Co. The switchgear was all supplied by the British Thomson-Houston Co., Ltd. (Rugby). All the high- and low-tension switchgear is in a separate bay, which runs the whole length of the turbine-house, and the switchgear is arranged on three floors. The H.T. switchgear is of the remote control type, and is in three groups. The group

'bus-bars are connected to the main or interconnecting 'bus-bars through oil switches fitted with an automatic maximum release with a time element. Cable boxes and transformers are on the turbine-house floor, oil switches and operating mechanism on the first floor, on which is also the control room, and the bus-bars on the second or top floor. The auxiliary switchboard for the 220 volts continuous current supply is erected in the switch-room adjacent to the main control-board. A 220-volt battery is also installed for the purpose of ensuring the supply of current for control purposes. With the exception of two of the four boiler feed-pumps and one boiler sump-pump, all the pumps and auxiliary machinery throughout the power-house are motor driven. The power-house also contains one motor-driven air-compressor, and a motor-driven vacuum pump for cleaning purposes, also two exhaust steam-feed water heaters and a water treating and filtering plant.

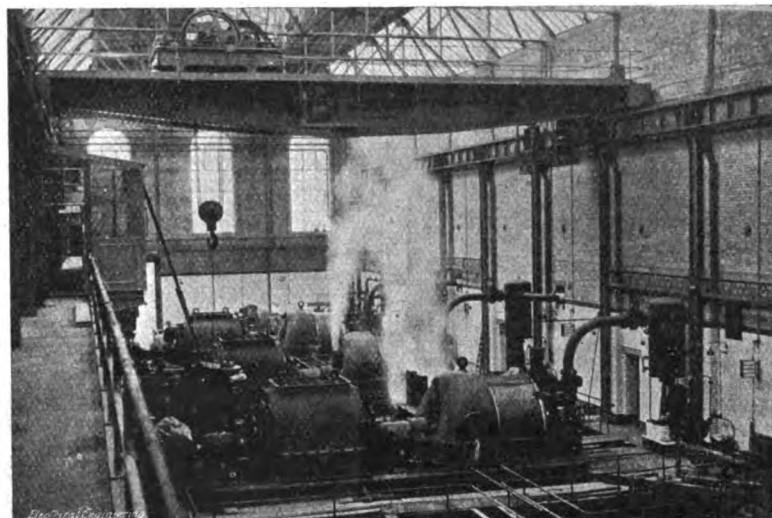
Under normal conditions the supply of circulating water will be obtained from the Wandle, and for conveying the water to and from the power-house two ferro-concrete ducts have been constructed. During periods of drought the supply from the river will be insufficient, and a part or the whole of the circulating water will be drawn from the outlet duct by means of motor-driven centrifugal pumps, and pumped over cooling towers which have been erected beside the water ducts at the end of the power-house nearest the river. The cooling towers were supplied by the Klein Engineering Co. Two motor-driven screens are provided in the inlet duct for removing leaves, weeds, and other refuse from the river water. The outer or coarse screen consists of fixed bars, cleaned by means of a motor-driven rake, and is capable of dealing with 2,000,000 gallons of water per hour.

The inner or fine screen is a rotating disc. The top of the disc is cleaned by water jets, while the bottom portion collects any fine particles or gelatinous matter that have passed through the outer screen. In flowing from the power-house back to the river, the water forms a series of cascades, and by this means it is cooled to within a few degrees of the inlet temperature before it is finally discharged into the river.

Feeders and Sub-stations.

The E.H.T. feeders to the sub-stations are 3-core, delta section, paper insulated, lead sheathed, single wire armoured, and jute served. Four sizes of cable, namely, 0·2 sq. in., 0·15 sq. in., 0·1 sq. in., and 0·06 sq. in., are used. The cables, as a general rule, are run beside the line upon hooks fixed to posts 5 ft. 6 ins. apart. Where it is necessary for them to cross the line or to run through station platforms they are laid in Howard asphalt troughing. A large proportion of the 11,000-volt feeder system is in the form of a ring main, and where duplicate cables are provided in this ring, they are fitted with protective gear consisting of balanced relays, which, in the event of a fault, isolate the length of defective cable at both ends. Duplicate cables which do not form part of the ring main are provided with balanced relays at the feeding end and balanced reversed power relays at the receiving end. Two lengths of single feeder are fitted with Merz-Price protective gear, in connection with which 3-core pilot cables have been provided. The cables were supplied by Siemens Brothers & Co., Ltd.

The 11,000-volt supply is distributed to nine sub-stations, at Waterloo, Clapham Junction, Raynes Park, Hampton Court Junction, Kingston, Sunbury, Twickenham, Isleworth, and Barnes, where it is converted to continuous current at 600 volts, at which pressure it is delivered to the track. The sub-stations contain transformers, rotary converters, and the neces-



INTERIOR OF TURBINE ROOM.

sary high- and low-tension switchgear. The rotary converters are of two sizes, viz., 1,875 and 1,250 kw., and were of the British Thomson-Houston Co.'s make; each of them is supplied from three single-phase oil-cooled transformers, manufactured by the British Electric Transformer Co. The switch-gear was supplied by the British Thomson-Houston Co. The high-tension gear is enclosed in moulded stone cells, and, with the exception that the oil switches are hand operated, is similar in construction to that installed at the power-house. Each of the continuous-current feeder panels controls two circuits, each of which have a maximum capacity of 5,000 amperes. The feeder circuit-breakers are equipped with indicating lamps which, when the breakers are open, show the position of the breaker through which the different sections of conductor rail are fed from the next sub-station.

The sub-stations, passenger stations, goods yards and sidings, between Waterloo and Clapham Junction, and on the "Kingston Roundabout" line, will take their lighting supply through a separate cable, which will also serve for supplying power in connection with the track circuit signalling arrangements. Single-phase alternating current at a pressure of 3,300 volts is supplied through this cable to static transformers placed in brick chambers at intervals along the route, current being transformed down to 220 volts. The 3,300-volt supply is obtained from frequency changer sets at the power-house and at Waterloo, Clapham Junction, Raynes Park, and Twickenham. Four of the sets consist of single-phase generators driven by 3-phase induction motors, which obtain their supply from the 11,000-volt bus-bars through transformers. To ensure reliable supply, three motor-generator sets are also provided. Two of these are at the power-house, and consist of single-phase generators direct coupled to 220-volt motors driven off the power-house auxiliary supply and storage battery. The third set is at Waterloo sub-station, and the motor driving the generator is, in this case, supplied from a 600-volt battery installed as a standby to the lighting of the terminal station. The 3,300-volt feeders are divided into sections at the transformer chambers, where they are connected to oil switches fitted with trip coils operated by relays, having operating coils connected to the copper tapes on the cables. In the event of a fault developing on a length of cable, the relays at each end of the defective length come into operation, and trip the oil switches, thus cutting out the length.

Track Equipment.

The track work involved in the electrification comprises the laying of a third rail and the bonding of the running rails of about 150 single-line miles of railway. The conductor, or third rail, is laid at one side of the track 16 ins. from gauge, and 3 ins. above rail level; it is of special high-conductivity steel, and weighs 100 lbs. per lineal yard. The resistance is approximately $6\frac{1}{2}$ times that of copper of equal volume. It is bent down at the ends to form the ramps, and is bonded at the joints with four copper bonds, having a total cross-sectional area of 1·4 sq. ins. The jumper cables connecting adjacent lengths of conductor rail at crossings and other points where it is necessary to have a gap in the rail are of 1 sq. in. sectional area, and are made up of 127 0·101 in. diameter copper wires insulated with rubber, bitumen-sheathed and braided. The return circuit is formed by the running rails, the joints of which are bonded with two copper bonds of the protected type placed under the fish-plates. These bonds are made up of copper strips, and have a total cross sectional area of 0·33 sq. in. The running rails are cross bonded at frequent intervals to equalise the current returning by the different rails. The track equipment was supplied by Siemens Bros. & Co., Ltd.

A description of the rolling stock will appear in our next issue.

ELECTRIC SUPPLY AT STOWMARKET

A NEW generating station has lately been completed at Stowmarket by the Suffolk Electricity Supply Co. to the designs of their engineer and secretary, Mr. Napier Prentice.

Two vertical four-cylinder gas engines, rated at 180 and 150 B.H.P. respectively at 250 r.p.m., have been installed, together with gas-producing plant, battery, and accessories. One interesting detail in these engines is the passing of the air supply through the crank chambers whereby the oil and moving parts are cooled. This also prevents oil leakage owing to the slight vacuum caused, while any gas escaping past the pistons is drawn off instead of being discharged into the engine-room. Some oil is, of course, drawn in with the air, but this simply drains back again from oil-separators. A view of one of these engines is seen in Fig. 1. Two air-compressors, belt-driven alternatively from one motor, are installed near the engines for charging the air-starting reservoirs to a pressure of 800 lbs. per square inch, either reservoir being available for either engine.

With the opening of the new station the voltage of supply

at Stowmarket has been raised from 100 to 200, and the dynamos, directly coupled to the engine, are wound for this pressure. The battery also has been increased to 110 cells, and it is charged and discharged through a hand-regulated Crompton booster, although regulating cells and switches are also provided for use at night and on light loads.

The gas-producers, of which there are two, together with the scrubbers, were designed by Mr. Prentice and built locally, a special feature being gilled pipes for cooling the gas immediately after production, as shown in Fig. 2. Water for the scrubbers is derived from a well, and raised by a motor-

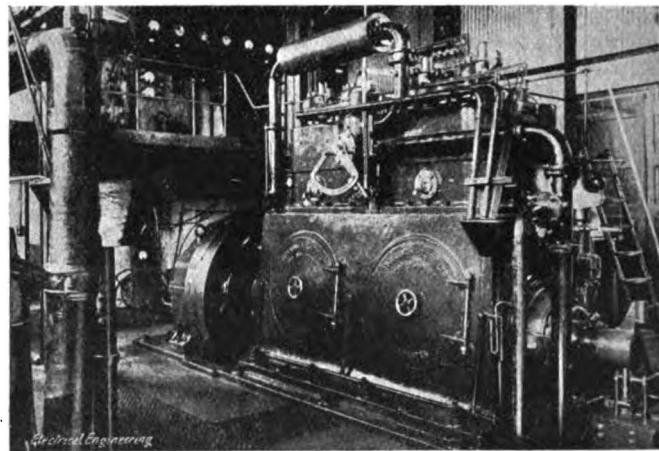


FIG. 1.—GAS-DRIVEN GENERATING SET.

driven pump into an overhead tank holding 1,000 gallons. A similar tank, mounted on the same wood framing, serves as an emergency supply for the cylinder jackets. The ordinary cooling water for the latter is circulated round a cooling tower of the Klein type by two motor-driven pumps, one of which forces the cooled water through the engines, while the other pumps from the hot-well over the tower. By discharging the engine exhausts near the top of an old boiler shell air is drawn from the engine-room through the pipe trenches. This air enters through steel screens surrounding the exhaust pipes coming down from the engines,

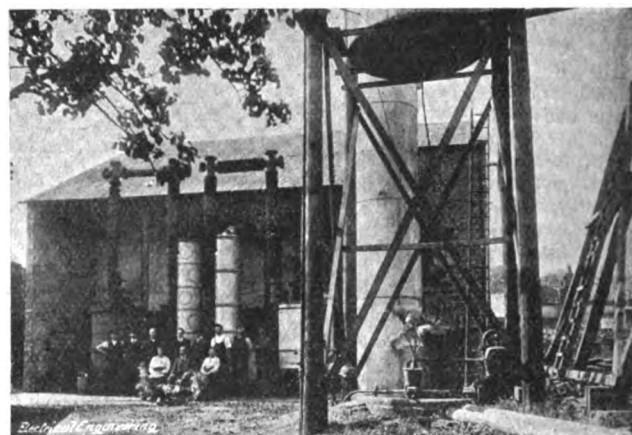


FIG. 2.—GAS-PRODUCER PLANT.

and carries off a large amount of heat which would otherwise make the engine-room very hot in the summer.

The engines were made by Messrs. Fielding & Platt (Gloucester), one dynamo by the General Electric Co., Ltd., and the other by Mather & Platt. The D.P. Battery Co. supplied the battery, while all the auxiliary motors were made by the East Anglian Engineering Co. (Stowmarket). Although the cooling tower was designed by the Klein Engineering Co. it was made locally. The new plant was all erected by the staff of the Suffolk Electricity Supply Co. under Mr. Prentice's supervision.

The New Manchester Electricity Works.—In the article on page 379 of our last issue, in which we reported Mr. S. L. Pearce's paper before the British Association upon the new Barton electricity works of the Manchester Corporation, a slight error occurs in regard to the capital charges. In the last few lines of the article we stated that the capital charges were 0·88d. per unit, whereas the context shows that the figure should obviously have been 0·088d.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 16th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

17,246/14. **Telephony.** G. MUSSO. A system for the transmission of telephone or telegraph current impulses over circuits of high capacity wherein the impulses are impressed on the main line from a local circuit, which includes an adjustable E.M.F. and an inductance so proportioned as to balance the capacity of the main line, sometimes with an adjustable condenser in series with resistance, connected in parallel with the inductance. (Four figures.)

19,121/14. **Conduits.** R. W. PERRY. Seamless conduit tubes arranged so that the lengths are connected together by screwing an external parallel thread on one end into an internal tapered thread in the enlarged end of the next section, so that a tight joint of good electrical conductivity is obtained. (Two figures.)

19,483/14. **Telegraphy.** W. JUDD, B. DAVIES, and EASTERN TELEGRAPH CO. A system of telegraphic reception intended chiefly for emergency use on cables in which signals are transmitted by impulses of opposite sign broken up at the receiving end into impulses of a frequency such as to be heard in a telephone. (Four figures.)

21,825/14. **Ventilation of Motors.** B.T.-H. CO. (G.E. CO., U.S.A.). A system of cooling particularly applicable to traction motors, in which air circulates both through and round the armature. The armature is connected at one end with the commutator through an airtight joint, and carries at the other end an enlarged head comprising a flange fitted with fan blades. (Six figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS AND TRANSFORMERS: SHEPPARD and YARWOOD [Motor starting] 2,490/15.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,461.

In fitting up a new mine with telephone instruments between underground sub-stations and power stations and other surface buildings, what are the factors entering into the problem which require special attention? What would be the most suitable description and sizes of cable and class of apparatus and general arrangement of circuits to meet the conditions shown on the sketch? The system is to be arranged so that a person

Ignition: CONNER [Magneto contact breakers] 641/15.

Storage Batteries: MOSSAY [Battery cases] 8,189/15.

Switchgear, Fuses and Fittings: B.T.-H. CO. (G.E. CO., U.S.A.) [Connections for resistances] 23,881/14; RADLEY [Drum-type controllers] 4,748/15; STRUGE [Suspension of electrolliers] 7,510/15.

Telephony and Telegraphy: HOEGERSTAEDT and TEMPEST [High-frequency generator] 12,910/14; MARKS (Morkrum Co.) [Printing telegraphs] 19,237/14.

Traction: IRVING [Signalling] 22,986/14.

Miscellaneous: SCHWERIN [Magnetic separators] 19,313/14; TYLER and BEERLE [Connections] 19,319/14; MACKENZIE (International Electric Tool Co.) [Electromagnetic percussive devices] 19,322/14; COOKE [Contact breakers] 21,368/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear: RENAULT [Controllers] 12,267/15.

Miscellaneous: GABET [Magnetic clutches] 12,301/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS AND TRANSFORMERS: C. A. PARSONS and G. G. STONEY [Field windings for turbo-generators] 12,408/03.

INCANDESCENT LAMPS: B. T.-H. CO. (W. P. BURROWS, U.S.A.) [Tabulating machine] 12,416/02; W. L. WISE (Moore Electrical Co., U.S.A.) [Vacuum tube lighting] 12,582/02.

INSTRUMENTS AND METERS: G. HOOKHAM [Meters] 12,009/08.

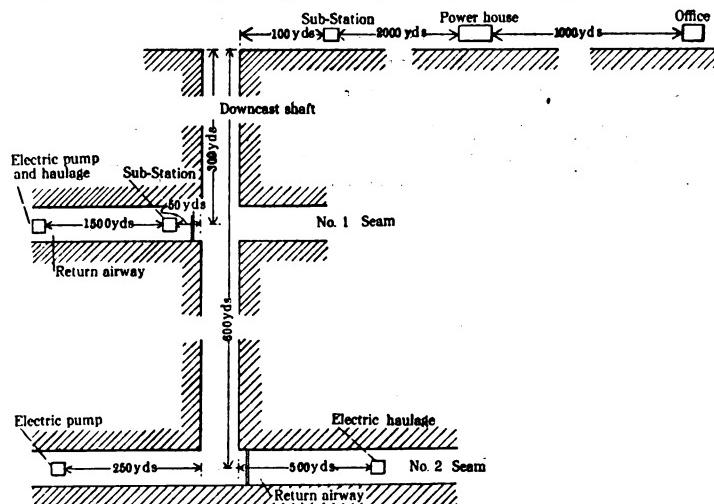
SWITCHGEAR, FUSES AND FITTINGS: ZUCKER FABRIK FRANKENTHAL [Controllers] 12,258/09.

TELEPHONY AND TELEGRAPHY: C. TURCHI [Telephone systems] 12,691/04; J. E. KINGSBURY (Western Electric Co., U.S.A.) [Telephone repeaters] 11,605 & 11,606/05 and 17,047/08.

TRACTION: M. B. CHURCH [Gearing for electric cars] 12,729/07.

MISCELLANEOUS: P. CRAMER [Indicator and regulator of the hygroscopic state of the atmosphere] 12,945/07.

could speak to the station or surface office from any other point, or could speak between any two points underground, and



must be arranged so that other points about mine can be added later.—"WORKER."

(Replies must be received not later than first post, Thursday, Sept. 30th.)

ANSWERS TO No. 1,459.

No reply worthy of an award has been received.

ANSWER TO CORRESPONDENT

"H. T."—It is impossible to say what the voltage on the crane trolley wires is. Presumably it is the same as the rest of the power supply on the premises, which is probably in the neighbourhood of 440 volts, unless only small motors are employed, when it might be about 220 volts.

"ELECTRICAL ENGINEERING" TRADE SECTION

CATALOGUES, PAMPHLETS, &c., RECEIVED

ELECTRIC POWER AND LIGHTING.—An illustrated booklet from L. E. Wilson & Co. (10 Corporation Street, Manchester), contains information as to various electric works driving, and other installations, carried out by the firm.

DIESEL ENGINES.—A leaflet from Mirrlees, Bickerton & Day (Hazel Grove, Stockport) contains a reprint of an article which appeared in a contemporary on the design of pistons and other engine parts particular from the point of view of presenting an excess of oil reaching the upper side of the piston.

THE FIREBRAND.—The Pyrene Co., Ltd. (19-21 Great Queen Street, W.C.), have issued the first number of a monthly circular with the above appropriate title, dealing with the capabilities of and results obtained by their Pyrene fire extinguisher, which employs a special liquid particularly suitable for use in case of electrical fires.

MERCURY VAPOUR LAMPS.—A pamphlet has been issued by the Westinghouse, Cooper-Hewitt Co., Ltd., 80 York Road, King's Cross, containing a reprint of an illustrated article on the artificial lighting of a moving picture studio, in which the application of mercury vapour lamps to this class of work is discussed.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

BOOKS.—A new catalogue of technical and scientific books, including a large proportion of electrical works, has been issued by the Hill Publishing Co. (6 Bouvierie Street, E.C.), agents for the McGraw-Hill Book Co., of New York.

ENGINEERS' PLANT AND TOOLS.—We have received a very comprehensive catalogue of foundry and engineers' plant and tools, &c., from Murphy, Stedman & Co., Ltd. (180 Gray's Inn Road). A considerable variety of handy appliances, machine tools, wood-working machinery, road tarring apparatus, and other contractors' plant is included, and it is important to note that the whole is of British manufacture.

ELECTRIC FIRES.—A catalogue from Ikin & Eads, Ltd. (47 to 57 Marylebone Lane, W.), gives in attractive form particulars of many designs of the "Qued" electric fire, the principal features of which were described in ELECTRICAL ENGINEERING, July 22nd, p. 316.

AN EDISWAN LAMP SHADE

A n illustration is given here of a very effective card-board shade, specially intended for showroom window lamps, which the Edison and Swan United Electric Light

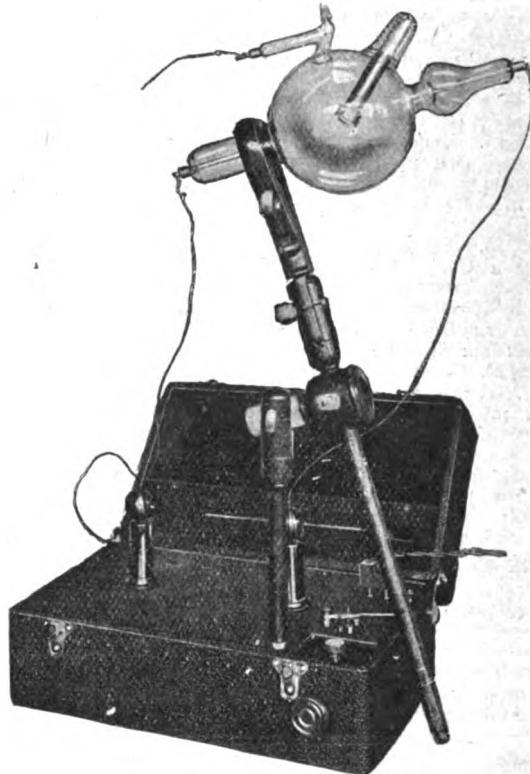


Co., Ltd. (Ponders End, Middlesex), are presenting to their trade customers free of charge.

A PORTABLE X-RAY OUTFIT

A RECENT publication of the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.) describes the "Dubilier" portable x-ray apparatus, which can easily be carried from place to place, and can be used direct on any ordinary electric light circuit, thus possessing considerable

advantages over the more cumbersome types of apparatus for x-ray work, whether for medicine, surgery, or dentistry. The pattern illustrated here, which is more particularly designed for dentists' use, employs a five-inch tube, and can work on either D.C. or A.C. at voltages from 55 to 250 volts. It is also fitted with an adjustable spark gap for use in high-frequency treatment, and attachments for cautery. The



DUBILIER PORTABLE X-RAY EQUIPMENT.

weight of the complete apparatus is 28 lbs. A larger size is also made. The apparatus is extremely simple, and there is only one switch and regulator to attend to. The current consumption is very small, and to judge by the radiographs reproduced in the catalogue, results are obtainable fully equal to those produced by larger apparatus.

AN ELECTRIC FIRE PUMP

I N the case of buildings where electric power is utilised, an electrically-driven pump is frequently adopted for fire protective purposes, and one of the most popular designs is the "Hatfield" treble-barrel type, made by Merryweather & Sons (Greenwich). Upwards of 1,000 of these pumps have been put into service. A recent example was installed in the fire station attached to a new extension of the works of the Kettering Clothing Manufacturing Society, which possesses a very efficient fire brigade.

The pump, which is electrically driven, is capable of delivering 300 galls. per min., and discharges into a 4-in. main, to which hydrants are attached. A special feature of the installation lies in the fact that automatic starting arrangements are provided, consisting of a solenoid starter controlled by relays in connection with a water-pressing indicator, so that on an outbreak of fire all that is necessary is to run out the length of hose nearest the fire and turn on a hydrant, when the pump immediately starts running. A considerable saving of time can thus be effected, as in the event of emergency there is no necessity to go near the pump. When the hydrant is closed, the electric current is automatically cut off and the pump ceases to work.

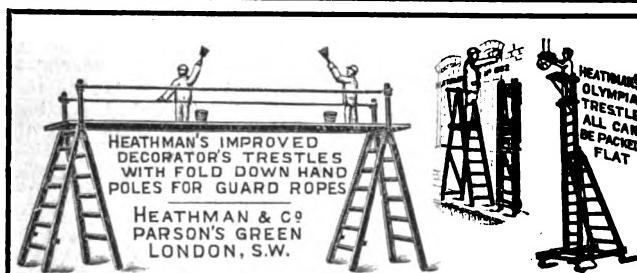
The water is supplied by two large underground tanks and four on top of the buildings, the total supply on hand being 62,000 galls. Two large branches are also taken direct from the Council's mains, one being laid on to the "Hatfield" pump, and the other to a ground hydrant with standpipe for the protection of the one-storey section of the buildings.



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Chiswell Works, 122-124, GOLDEN LANE, E.C.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aldershot.—The Council has taken up a loan of £6,194 in connection with the electrical undertaking at 4½ per cent.

Buxton.—A distributing cable at an estimated cost of £165 is to be laid.

Liverpool.—Three months' supply of electrical goods for the Toxteth Park Guardians. Clerk, 15 High Park Street, Liverpool. Sept. 25th.

London: Islington.—An expenditure of £500 is to be incurred in order to provide an alternative supply from the Corporation mains. Apparently the infirmary authorities are going to shut down their existing generating plant, as the Chairman of the Lighting Committee anticipates a saving of £2,000 by the adoption of the new scheme.

Sheffield.—Increased demands from factories working upon Government contracts have rendered it necessary to instal additional generating plant at an estimated cost of £100,000. The Ministry of Munitions has been approached in connection with the matter, and has given its consent, and also undertakes to make arrangements whereby at the close of the war the new plant shall be sold to the Corporation or dealt with in some way on fair terms to both sides should the Corporation not require to keep it.

South Africa.—H.M. Trade Commissioner at Pietermaritzburg records the need for additional generating plant in the Corporation's power station.

Swindon.—An overhead transmission line is to be erected to supply Messrs. Grundy's factory at a cost of £281.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Barnsley.—New Town Hall.

Dudley.—A number of new factories are about to be erected.

Mansfield.—Extensions to Isolation Hospital.

Nottingham.—Extensions to City Isolation Hospital. Town Clerk.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London.—Pope's Electric Lamp Co. has received orders for several thousands of lamps, both carbon and metal filament, from the Admiralty, War Office, and H.M. Office of Works.

H.M. Office of Works.—A contract has been placed with the "Z" Electric Lamp Manufacturing Co. for a twelve months' supply of "Z" drawn-wire metal filament lamps.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £86 10s. to £87 10s. (last week, £84 to £85).

Dissolution of Partnership.—H. E. How, C. L. Arnold, and C. R. Bellings, trading as Bellings & Co., specialists in electric heating at Derby Road, Edmonton, have dissolved partnership. The business in future will be carried on by C. R. Bellings.

Change of Address.—The Fuller Electrical & Manufacturing Co. have changed their address to Canada House, Kingsway, W.C.

The Association of Mining Electrical Engineers.—The annual general meeting of the Association will be held on October 2nd at 3 p.m., at the Midland Hotel, Manchester. The meeting is entirely a business meeting, other usual arrangements having been abandoned.

APPOINTMENTS AND PERSONAL NOTES

Mr. Arthur James, who until recently was outside representative for the Record Electrical Co., Ltd., for Lancashire and Yorkshire, has now joined the board of directors of the company, and has transferred his activities to Scotland.

The Belfast Tramways and Electricity Committee requires a senior and a junior Engineer-in-Charge. The wages are £4 and £3 per week respectively. Applications to the City Electrical Engineer by Sept. 24th.

An application by Mr. R. A. Traill, Burgh Electrical Engineer at Lossiemouth, for an increase of salary has been put on one side for the moment by the Council, in view of the warnings of the L.G.B. as to the reduction of expenditure.

LOCAL NOTES

Aberdeen: *Increase in Charges.*—By the casting vote of the Convenor of the Electricity Committee, the Corporation is recommended to add 15 per cent. to all accounts of consumers in the Electricity Department.

Birmingham: *Unauthorised Electrical Installation.*—The licensee of the Aston Theatre Royal was summoned in the Birmingham Police Court last week for using an electrical installation before it had been inspected by the Electricity Department. The summons arose out of a fire which occurred at the theatre. The offence was admitted, and a fine of £5 and costs was imposed.

Brighton: *Increased Charges.*—The Corporation is recommended to increase the charge for lighting from 4½d. to 5d. per unit, and for power and heating from 1½d. to 1¼d. per unit. A local paper reflects that when times are prosperous the ratepayers share the Electrical Department's profits, but when times are hard the consumers alone have to pay.

Dublin: *The Wiremen's Strike.*—A somewhat curious, although not unexpected, position has arisen in Dublin in connection with the strike of electrical wiremen notified on page 384 of our last issue. The men have found it so easy to get employment in munition factories in Belfast, Glasgow, and in England that, according to the local newspapers, practically all the dissatisfied wiremen have migrated in this way, with the result that great difficulty is being encountered in carrying on the ordinary wiring work in Dublin.

Harrogate: *Electricity Finances.*—A discussion took place at the last meeting of the Corporation with regard to a suggestion by the Lighting Committee that all revenues of the electrical undertaking should be handled directly by the Department, instead of by the Borough Treasurer's Department as at present. On the other hand, the Finance Committee presented a recommendation that it would be inadvisable to alter the present arrangements. In support of the Electric Lighting Committee's proposal, the Chairman of the Committee pointed out that it was an advantage for the Department to get into as close touch as possible with its consumers in order that every possible use of electricity might be brought to their notice. Apparently the matter has been the cause of some little friction, as letters from Brighton, Bristol, Southampton, and elsewhere have been received in support of the proposal. Eventually, however, the proposal of the Lighting Committee was defeated by 18 votes to 10.

New Tariff.—Mr. G. Wilkinson, the Borough Electrical Engineer, recommends the adoption of a rateable value tariff on the basis of 15 per cent. plus ½d. per unit, or ¾d. per unit for any approved current-consuming device having 100 per cent. load factor with automatic control. This tariff is to apply to private residences where a reasonable amount of "other uses" apparatus is installed.

Keighley: *Complaint Against Extensions.*—At the last meeting of the Council Alderman Midgley complained that the

Electricity Department is constantly doing work without the knowledge or sanction of the Council, and incidentally he protested against the way in which the Department was alleged to be spending money at a time when the strictest economy was being urged all round. Cables, he said, were being laid to supply private users all over the town, notwithstanding the statement of the Engineer that the works could not meet the present demands. He consequently moved that a recommendation for a 40-ton crane at the electricity works at a cost of £788, and also for a centrifugal pump at a cost of £350, be referred back. The reference back was carried.

Peterborough: *Increased Charges.*—The desirability of increasing the charges for electric light and power came before the City Council at its last meeting in the form of a paragraph from the Electricity Committee that there should be an increase of ¼d. per unit. Evidently, however, the Committee did not consider this a sufficient increase, for the Chairman asked that the matter should be referred back for further consideration. It was pointed out that the Committee had a very serious position to consider, having regard to coal of a similar quality to that which was paid 8s. 7d. per ton for in 1907 now costing 21s. 4½d. per ton.

Pontypridd: *Electricity Accounts.*—There was a loss of £181 upon the electricity undertaking last year compared with a profit of £1,083 in the previous twelve months.

The Northern Universities and the War.—We have been favoured with a copy of a letter which the Vice-Chancellors of the Universities of Manchester, Liverpool, Leeds, and Sheffield have addressed to the committee appointed by the Treasury to consider the question of public retrenchment, the purpose of which is to deprecate the withdrawal of certain Government grants which are enjoyed by these institutions. Attention is drawn to the great services which these Universities have been able to render to the State, notwithstanding the depletion of their ordinary income and other disorganisation due to the war, and an excellent case is made for a continuance or even an enlargement of the Government subsidies, without which their present work and future powers would be seriously crippled.

The Gretna Railway Disaster.—In his report upon the disaster to a troop train on May 22nd near Gretna, Col. Drury, in his recommendations for the prevention of the terrible results arising from fire breaking out in wreckage after a bad collision, besides recommending that the coaches should be made of fireproof material as far as possible, emphasises the necessity for "the provision of electric lighting in all new stock, and gas lighting in existing stock to be abolished and electric lighting to be provided as opportunity admits." He remarks further that most of the principal companies are providing electric light in all new carriage stock, and some are arranging to convert existing gas-lit stock as opportunity occurs, but this must necessarily be a slow process spread over many years.

Munitions Works Dispute.—Complaints were laid at a local court of the Metropolitan Munitions Tribunal on Monday against a number of employees of a telephone manufacturing company which is engaged on war work, for breach of regulations. It was explained by Mr. Burney, the Managing Director of the Company, that in order to arrange a more complete night shift certain new hours and regulations were put into force, but the men complained of refused to conform to them. Several of them had remained away from the works for a day or two. The men, on the other hand, argued that they had not been given notice of the alterations, but the court ruled that the men had been notified in sufficient time, and seven of them were fined £1 each. Another man implicated had since returned to work, and was not fined.

A Convenient Calculator.—A new form of reckoning chart for multiplication, division, squares, cubes, &c., has been prepared by Dr. E. E. Fournier D'Albe, and is published by the Educational Supply Association, 40-44 Holborn Viaduct, E.C., at 3d. net. It depends on the use of a logarithmic scale ruled at an angle 45 degrees across similar horizontal and vertical scales. Calculations can be very rapidly checked simply by injection with an accuracy claimed to be within one per cent.

Ediswan—B.T.-H. Shooting Match.—This competition between the Ediswan Rifle Club and a team from the British Thomson-Houston Co., Ltd., resulted in a win for the Ediswan team with a total of 1,579 against 960. Messrs. E. Winterflood (Ediswan), and Redfern (B.T.-H.) were awarded silver spoons presented by the Ediswan Rifle Club for the highest scores on the two sides, and wooden spoons consoled those who made the lowest scores.

The Association of Supervising Electricians.—This Association commences its second season on Tuesday, Sept. 28th, at 8 p.m. at St. Bride's Institute. The Presidential Address will be given by Mr. A. H. Dykes. A complete programme of papers has been arranged for the ensuing season.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, SEPTEMBER 30, 1915.

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SUMMARY

THE effect of variation in frequency on a fan motor is discussed in our Questions and Answers columns (p. 394).

THE equipment of the electric trains for the suburban lines of the London and South Western Railway is described in an illustrated article. A control system giving automatic acceleration is employed (p. 395).

A NUMBER of books on electrical engineering and allied subjects are reviewed on pp. 396 to 398.

EXPERIMENTS are being made with some success in America in communicating with moving trains by wireless telephony (p. 398).

THE annual conference of the Municipal Tramways Association was held in London last week. A discussion upon the effect of the war upon tramway undertakings took place, but there was some divergence of opinion as to the advisability of increasing fares (p. 398).

AMONG the subjects of specifications published at the Patent Office last Thursday were lampholders, electric hammers, motor starters, and accumulator cases for motor vehicles. Opposition has been entered to two electrolytic patents and a patent for a cable-testing pressure tank expires this week after a full life of fourteen years (p. 399).

A 3,000-VOLT regulator is required at Dunedin (N.Z.); a new turbo-alternator will shortly be required at Bootle; mains extensions are contemplated at Basingstoke and Plymouth; seven 200-kw. transformers are

required at Hammersmith; a cooling tower at Pembroke (Ireland); and flame arc lamp carbons at Salford (p. 401).

A CONSIDERABLE addition has been made to the number of electrical undertakings which have increased prices. On the other hand, the Newcastle-on-Tyne Electric Supply Co. has reduced its charges for supply for heating and cooking purposes.—The Salford Corporation is now taking less electrical energy from the Lancashire Electric Power Co. in consequence of the installation of the new 5,000 kw. set.—The proposal of the Newquay Electric Light and Power Co. for an increase in the maximum price in its provisional order is meeting with strong opposition (p. 402).

A QUARTERLY dividend of 1½ per cent. is declared on the common stock of the Westinghouse Co. (p. 402).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS by Lt.-Colonel C. B. CLAY, V.D., Commandant.

Drills, 6.30 to 7.30; 7.30 to 8.30.

To-DAY, Thurs., Sept. 30th: Section III., technical. Section I., shooting.

Fri., Oct. 1st: Section IV., technical. Section II., squad, signalling class.

Sat., Oct. 2nd: Company parade, 2.30 p.m. Route march.

Mon., Oct. 4th: Section I., technical. Section IV., squad, signalling class.

Tues., Oct. 5th: Section II., technical. Section III., shooting.

Thurs., Oct. 7th: Section III., technical. Section II., shooting.

Fri., Oct. 8th: Section IV., technical. Section I., squad, signalling class.

Sat., Oct. 9th: Company parade, 2.30 p.m. Route march.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Arrangements have been made to share headquarters with the 4th Battalion Central London Regiment Volunteers, at Chester House, Eccleston Place (three minutes' walk from Victoria Station, Brighton Line).

Boiler Practice.—The annual memorandum issued by Mr. C. E. Stromeyer, Chief Engineer to the Manchester Steam Users' Association, contains a reprint of the Association's leaflet on Advice to Boiler Attendants, followed by comments addressed more to owners of boilers. Mr. Stromeyer discusses in detail the several items in boiler expenses, such as coal bill, repairs and renewals of boilers, stokers, feed-water heaters and economisers, and in a general summary he shows that the annual expenses for an average size boiler may, under favourable conditions and good management, be as low as £394 per annum, and as high as £700 if adverse conditions are coupled with bad management. The sources of these expenses, and the means for reducing them, are discussed in the concluding portion of the memorandum, which deals with the smoke nuisance, with burning qualities of coal, the clinkering qualities of their ashes, with the wasting of firebrick furnaces, and with grease, scale, and corrosion.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,462.

Please describe an inexpensive workshop method of varying the frequency of 60 periods 50 per cent. either up or down; expensive and elaborate arrangements out of question, as the changes are only required for testing purposes.—W. E. L."

(Replies must be received not later than first post, Thursday, Oct. 7th.)

ANSWERS TO No. 1,460.

I have a 100 volt 50~ small table fan (series wound) which will not run on a 105 volt 83~ current. Is this due to the difference of the currents, or is there a fault in the fan? A current passes, causing the fan to hum. What is the general effect of a change of voltage and change of periodicity on such a motor? Should a similar 100 volt D.C. motor run on 100 volt 50~ A.C. circuit?—K. E. N.

The first award (10s.) is given to "E.B.P." for the following reply:—

The motor could hardly be expected to run efficiently on the 83 cycle current, owing to this frequency being so much higher than that for which it has been designed, although one would not expect it to refuse to run altogether. The effect of the higher frequency would be an increased back E.M.F., with a corresponding reduction in the current taken by the motor, and consequently in the torque developed by it. There would also be an increase in the heating of the motor. Under these conditions, one would expect the motor to run considerably slower than its normal speed.

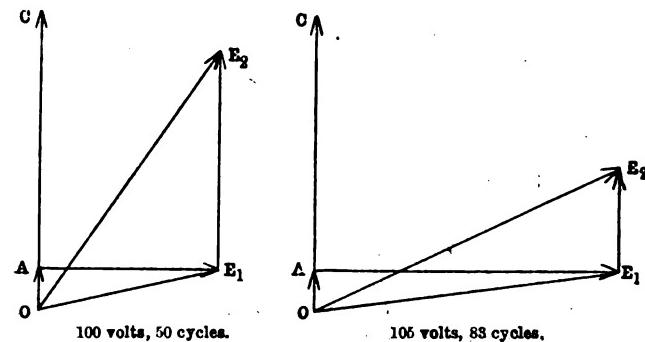
I would say that probably the motor is not really series wound, but is a repulsion motor; that is, a motor having an armature and field coils somewhat similar to a D.C. series motor, the field magnet alone being supplied with single-phase current, while the armature is not connected with the external circuit at all, but has its brushes short-circuited. If the brushes of such a motor are set in the right position it will run when supplied with single-phase current, having a characteristic curve very similar to that of a D.C. series-wound motor. By shifting the brushes the rotation can be reversed, and the proper position can be found by trial. In the present case the brushes may not be short-circuited, or they may be set in the neutral position, or the motor may be connected—wrongly—with the armature and field magnet in series. Any of these faults would prevent the motor from working, while allowing a current to pass through the machine. However, in any case, the motor will not work well on the 83 cycle circuit, its speed will be low and its heating excessive.

The effect of a change of voltage on such a motor will be a proportionate change of current, with a corresponding increase or decrease of speed. I have indicated above what the effect of

a change of periodicity would be. A 100-volt D.C. motor connected to a 100-volt 50-cycle alternating supply would in all probability run, but for similar reasons to those discussed above, at a reduced speed. Moreover, unless the field magnet were entirely built of laminations, it would get excessively hot, due to eddy currents caused by the alternating flux.

The second award (5s.) is made to H.J.E., who writes as follows:—

The table fan in question certainly ought to run on 100 volts 83 cycles, but at a lower speed than on 100 volts 50 cycles. This is obvious when one refers to the vector diagram of a series A.C. motor. In Fig. 1, let AO represent the ohmic drop in phase with the current OC , whilst E_1A represents the E.M.F. produced by the pulsating field in the stator winding. The E_1E_2 is the E.M.F. produced in the armature winding by the latter's rotation in the field flux. The resultant vector OE represents the terminal PD . Now E_1A is directly proportional to the periodicity of the supply. Consequently for the same



terminal voltage, E_1E_2 will be smaller on 83 cycles than on 50 cycles, and thus the armature is only required to run at a lower speed. In order to give as good results on 83 cycles the stator should be stripped and rewound with 60 per cent. of the existing turns per pole. If the periodicity of the supply is kept constant, the speed of the motor on a fan load is approximately proportional to the applied voltage. On the other hand if the applied PD is kept constant, the speed will be approximately inversely proportional to the periodicity of the supply.

With regard to the last part of the question, "K. E. N." is referred to the answer to Question No. 1,457, in ELECTRICAL ENGINEERING, Sept. 9th.

UNIVERSITY AND TECHNICAL COLLEGE ANNOUNCEMENTS

FULL information as to the session which commenced at Armstrong College, Newcastle, last Monday is contained in the new issue of the calendar which we have just received. The courses in electrical engineering are under Prof. W. M. Thornton, assisted by Mr. W. W. Firth. Both day and evening classes are held. A special feature of the college is the Mining Department, the courses in which include instruction in mining electrical engineering. The work is being carried on uninterrupted, in spite of the fact that some of the departments are just now housed in temporary premises.

The Borough Polytechnic Institute reopened for the present session last Monday. A four years' general course in electrotechnics is given under Dr. J. Henderson, and there are also special courses in electric wiremen's work and in electrical construction and workshop drawing.

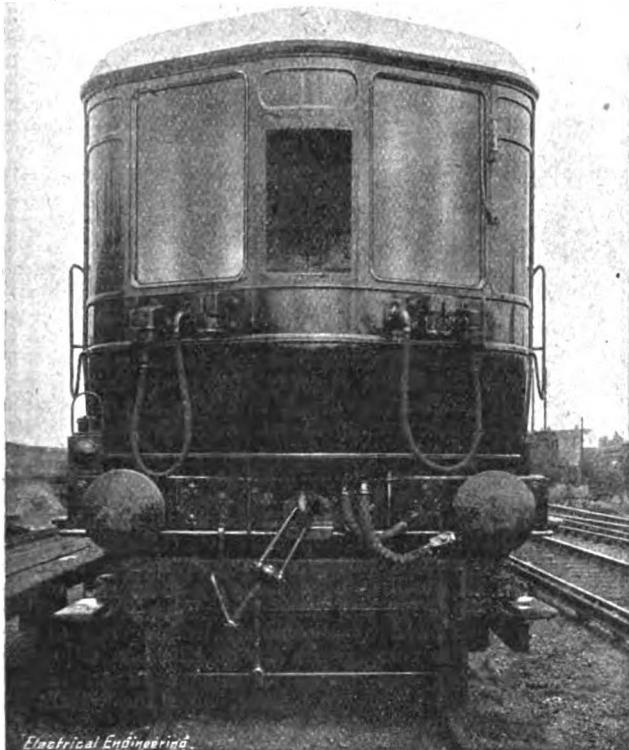
London Lighting.—Sir John Simon, in reply to a question in the House of Commons on Thursday last, said that the reduced lighting in the metropolitan area had been most carefully studied, and the scheme adopted was based on the result of repeated observations alike from the air and from the ground. The main object to be aimed at was uniformity rather than absolute darkness, and it was a matter of great importance that the scheme should be applied equally in all parts of the area, exceptional darkness being as likely to prove a distinctive mark as exceptional brightness. Private citizens and local authorities had shown themselves generally willing to accept the application of the scheme, and the lighting orders made to give effect to it, but as some cases of local departure from the scheme had come to his notice, he was proposing to make a fresh Order defining more exactly some of the requirements, as, for instance, in the matter of the lights in private houses, and giving the police increased power to enforce it.

ELECTRIC TRACTION ON THE LONDON AND SOUTH WESTERN RAILWAY

Rolling Stock

THE rolling stock consists of 252 51 ft. compartment-type coaches, until recently used in steam service and now converted for electrical working.

The trains are equipped for multiple unit working, and for convenience in handling are made up of three-coach units, consisting of two motor coaches with a trailer coach close-coupled between them. It is intended to operate these units



Electrical Engineering

FIG. 1.—FRONT OF MOTOR COACH, SHOWING CABLE COUPLINGS, &c.

as three or six-coach trains, depending upon traffic requirements.

Each three-car unit is equipped with four motors, each rated at 275 h.p. at 590 r.p.m., geared with a ratio of 21 to 59 to standard 42½-inch driving wheels. These motors are arranged in pairs on the bogies underneath the driving compartments at opposite ends of the unit. All the control gear is placed in these compartments, each pair of motors being controlled by its own set of control gear. The positions of the individual pieces of apparatus have been carefully arranged for ease of access for inspection, cleaning, and adjustment with this end in view. Access to the control apparatus is obtained on the one side from the driver's compartment and on the other through large hinged doors in the partition between the driver's and luggage compartments. The weight of this apparatus comes over the driving bogie and so increases the adhesive weight on the driving wheels. For the electric trains the original rolling stock, consisting of the usual compartment coaches with side doors has been used, the necessary alterations being made to fit them for the electrical apparatus. The appearance of the curved front of the leading coach is shown in Fig. 1.

The electric equipment was supplied by the British Westinghouse Co. The motors are of the latest series-wound totally-enclosed type, with box frames, and the bearings carried in end housings. They are equipped with commutating poles. The field poles are laminated and the interpoles are made solid and have a special shape of tip. Spring washers are used in both cases to keep the coils firm in their places and to prevent chafing due to vibration. A fan is provided on the armature for air circulation on the axial system. Air drawn through openings in the commutator spider and armature core passes through the fan and back between the field coils and over the armature and commu-

tator. Openings to the atmosphere are not provided; the whole of the cooling is done by radiation from the case, but the circulation of air ensures even temperature throughout the motor. The brush holders are substantial bronze castings, clamped to the machined face of the casting, which is supported by two insulated rods bolted to the motor frame. The insulation is of pure mica directly surrounding the rods which are forced into their place in the casting by a considerable pressure, the mica being protected during this process by hardened steel split tubes. The brushes are arranged for radial adjustment to allow for wear of the commutator and are readily accessible for inspection and adjustment through the commutator trap door. The motor casing is carried by a suspension bracket, which is supported through rubber springs from the truck transom.

The control of the trains for multiple unit working is effected by the Westinghouse Company's "All Electric" system of automatic relay control. In this system the motor current is handled by a suitable number of electrically operated contactor switches, the operating coils of which are connected to control wires running throughout the length of the train and actuated by six small master controllers. The contactors are provided with interlocking switches connected in their operating circuits to ensure the correct sequence of changes in the connections. The motor equipment on each coach is controlled during the accelerating periods by its own relay, which is independent of the other relays on the train; hence the motors on the different coaches are notched up in accordance with their individual requirements, which are, in a measure, dependent upon the diameter to which the wheels may be worn and the slight inherent differences in the characteristics of the motors. This system, therefore, helps to equalise the load on the different motor coaches. The operation of the controller is extremely simple, the driver having merely to move the controller right round to the full "on" position, and the relays automatically do the rest. Powerful magnetic blow-outs are fitted to all pieces of apparatus where there is a possibility of arcing when breaking current. The arcing tips are of hard drawn copper, which can be easily and cheaply renewed. A wiping action between the contacts is provided, so that any roughness due to arcing when opening the circuit does not interfere with the contact surface when the switch is in the closed position. Each con-

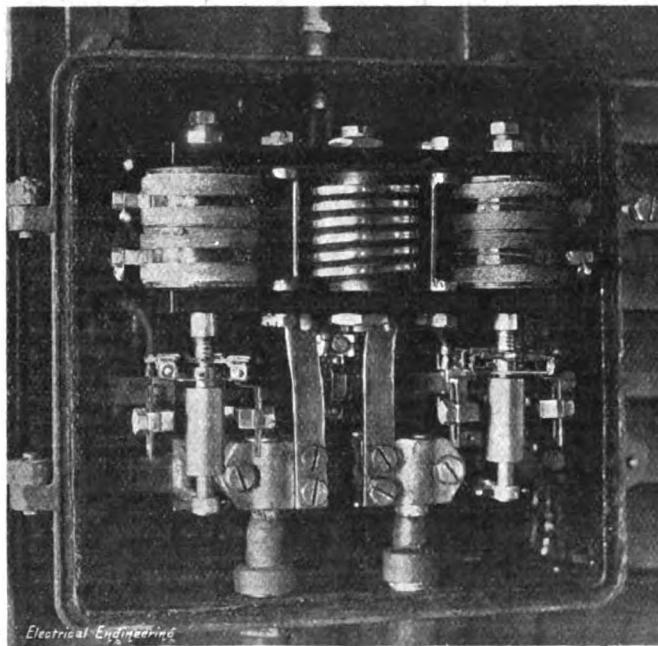
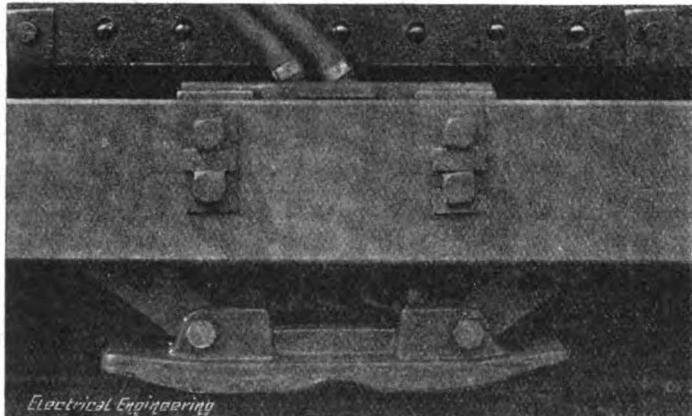


FIG. 2.—AUTOMATIC ACCELERATION RELAYS.

tactor and circuit breaker is carried by a pressed steel plate clamped to mica insulated steel tubes, which are fixed to two channel irons running the full length of the switch group. This method of construction is light and strong, and has the necessary flexibility to withstand vibration. It also renders the withdrawal and replacement of a contactor switch an extremely easy matter. The interlocking switches are fixed at the back of the contactor switches, and are operated by a lever from the movable core of the contactor solenoid, thus ensuring a definite position of the interlocking switch, corresponding with a definite position of the contactor. These

interlocking switches have been most carefully designed with a view to ready inspection, renewal and withdrawal when necessary. The smallest possible number of different parts is used in the construction. The frame carrying the contactor switches forming the motor car group lies across the width of the coach in the driving compartment. It also carries the necessary motor starting resistances and the main fuse above the contactors. The motor resistances are of the usual three-point suspension grid type, mounted on mica insulated tie bars fixed to pressed steel end frames, giving a strong and rigid construction. The circuit-breaker is similar in construction to the contactor switches. It is provided with heavy laminated brushes in addition to the contact jaws, and adjustable overload and trip coils. The reverser is of the drum type.

The master controller is provided with both main and reversing handles, so interlocked that the reversing handle must be either in the forward or reversed position before the driver can operate his controller. The main handle embodies the "dead man" feature, the arrangement being such that in the event of the driver releasing the handle the supply of control current is interrupted, thus opening all the main contactors. The brakes are automatically applied at the same time. Should the driver allow the handle to move upwards at any time, he must bring it to the "off" position again before he can release the brakes. When coasting and when making ordinary service stops the driver moves the main handle to the "off" position and keeps his hand on the handle, thereby preventing the interruption of current and the automatic application of the brakes. The main handle of the master controller has four positions : The first position, usually



Electrical Engineering

FIG. 3.—CURRENT-COLLECTING SHOE.

called the "switching" position, gives series connections to the motors with all resistance in circuit; the second position brings the automatic relay into operation and the resistances are cut out of circuit step by step until full series is obtained; the third position connects the motors in parallel; the fourth position brings the automatic relay into operation again, cutting out the resistance step by step until full parallel is obtained. It is unnecessary to pause on each notch of the controller until the corresponding motor connections are completed, but the handle may be moved directly to either the series or parallel positions, when the control apparatus automatically notches up step by step until the position is reached corresponding to the particular notch on which the handle is placed. The starting current, and therefore the rate of acceleration, may be adjusted by means of the setting of the automatic relay; this relay consists of three coils, two of which have movable plungers fitted with copper discs for bridging contacts in the control circuit, the three coils having a common magnetic circuit. The two coils which have movable plungers are connected in the control circuit and the third coil is a heavy current coil connected in the motor circuit. The function of the two coils in the control circuit is to lift the short-circuiting copper discs and thereby open one of the control circuits, the discs being held up until the motor current in the series coil has fallen to the pre-determined value for which the relay is adjusted. The contacts in the relay are never used for breaking circuit, and are, therefore, not liable to cause trouble by burning. The construction of the control apparatus throughout is of non-inflammable material, and the whole of the insulation is of mica. The whole of the cable for the control, lighting, and heating circuits, etc., was supplied by Chas. Mackintosh & Co. Practically all the wiring is in the driver's cab, and the connecting train wires and through shoe cable are fixed on the

roof of the coach so as to be out of reach of unauthorised persons. The coaches are heated by electric radiators suitably grouped in the various compartments.

From the last paragraph of our article of last week describing the track equipment it might be inferred that Messrs. Siemens Brothers' cable contract included the low-tension cables in connection with the track. This, however, is not so, for the whole of the low-tension feeder cables between the sub-stations and the track, as well as the cross-bonds, jumper cables, &c., were supplied by Chas. Mackintosh & Co. (22 Jewin Street, E.C.). This was a very large contract, including many miles of rubber, bitumen, and paper-insulated cables. We much regret that through a misunderstanding Messrs. Mackintosh's name was not mentioned. It has also been noted above that a large quantity of cable for the wiring of the rolling stock was supplied by the same firm.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

Specification and Design of Dynamo-Electric Machinery. By Miles Walker. 648 pp. 10 in. by 6½ in. 538 figures. (London : Longmans, Green & Co.) 32s. net; abroad, 38s. 4d.

There are few authors better qualified to deal with dynamo design than Prof. Miles Walker, who is not only personally responsible for much progress in the subject, but is a clear writer and an original thinker. This originality is shown in the planning of the book, which does not profess to be a complete treatise on the design of every kind of dynamo-electric machinery, but handles the subject in a way that we do not remember having seen attempted before. Addressing himself as much to the consulting engineer as to the designer, he makes the main feature of his work the second part, in which, after a few words as to the drawing up of specifications in general, he gives a series of some eighteen model specifications for A.C. and D.C. plant, including generators (both engine and turbine driven), motors, rotary converters, boosters, phase advancers, &c., all worth detailed study by those responsible for central station design and extension. Each one of these specifications is followed by a complete working out of the data of a machine to comply with the specification following exactly the methods that might be adopted in an actual designing office, and based, we believe, upon the system of design sheets used by the Westinghouse Company. It is in this dual arrangement that the value of the book lies, not, be it understood, simply in providing the engineer with a ready-made specification to copy or alter to suit his particular case, or the designer with a short cut to arrive at a machine to put forward, but in enabling the engineer by reading the design section to see why it is advisable to raise certain points and observe certain limitations in his specification; while the designer by familiarising himself with the specification section can see into what channels his designs must be directed to meet the requirements likely to be laid down. Excellent as the method of design put forward, we do not think Prof. Walker ever intended it to be followed slavishly by every reader of the book, and, indeed, there are no two designing offices where exactly the same procedure is adopted. He has given us, however, examples of the very best modern practice, and discussed them in a way that should stimulate further advance rather than lead to stagnant standardisation.

The first part of the book, although we have chosen to refer to it second, is on an equally high level, and, treating the subject in a more general way, lays down main principles, and deals successively with the magnetic circuit, the electric circuit, the manufacture and design of armature coils, insulation, ventilation, and the predetermined of temperature rise. The results of much recent research are included, and the practical points of construction which differentiate between the work of an "electrician" and that of a true "electrical engineer" are most admirably brought out. The industry and the profession of electrical engineering are distinctly the richer by the possession of such a book.

Continuous-current Electrical Engineering. By W. T. MacCall. 466 pp. 8½ in. by 5½ in. 385 figures. (London : W. B. Clive.) 10s. 6d.; abroad, 11s.

It has been the author's aim to provide in this work a manual for students in technical schools and colleges, especially those preparing for certain examinations, but the book should not be without its utility to others seeking to improve their general knowledge of electrical engineering

matters. The range covered includes continuous-current working only, and extends pretty widely into the fields connected with general principles, electrical measurement, dynamos, batteries, lighting, distribution, and traction. Mathematical theory is not deeply gone into, and real modern engineering practice is the basis upon which the treatment is founded throughout. This practical nature of the work is evidenced by the fact that the introduction deals first with the general functions of a generating station even before such matters as units of measurement are discussed. The illustrations are good and numerous, and also serve to explain the application of the principles taught to practical use. The treatment is necessarily somewhat superficial in places, but this is due more to the class of book which the author has undertaken to write rather than to the way he has written it. A large selection of examples to be worked by the student are given, and the general style of the work is of good quality.

Advanced Theory of Electricity and Magnetism. By W. S. Franklin and B. MacNutt. 300 pp. 8*½* in. by 5*½* in. About 260 figures. (New York: Macmillan Co.; London: Macmillan & Co., Ltd.) 8s. 6d. net; abroad, 9s.

Although dealing with theory, it has been the authors' endeavour, as they forcibly express it, to "keep the student's mind jammed up right against physical things," and to lift the treatment above a purely formal mathematical exercise. Starting theoretical considerations on magnetism, electromagnetism, &c., the first part concludes with a special chapter on the mariner's compass and the means by which its errors are compensated. The second part deals with electric charge, field, and potential, and culminates with an interesting treatment of electric oscillations and waves, which forms a considerable part of the book. Finally the electron theory (accidentally referred to in the contents as the *electron theory*) is briefly spoken of in Part III., which also skims over some other matters. We do not remember having seen a work taking up quite this interminate attitude between theory and practice before, and to a certain class of student a work of this nature should not be without utility.

Constant-voltage Transmission. By H. B. Dwight. 115 pp. 7*½* in. by 5 in. 14 figures. (New York: John Wiley & Sons; London: Chapman & Hall, Ltd.) 5s. 6d. net; abroad, 5s. 9d.

The main title of this book does not sufficiently explain its contents without the sub-title, which is: "A discussion of the use of synchronous motors for eliminating variation in voltage in electric power systems." The influence of the power factor on the drop in long transmission lines is, of course, tremendous, and the author's case is that not only is it of advantage economically to instal power-factor raising plant, but that dependence can be placed on such apparatus from a technical point of view for controlling the voltage of lines at the opposite end to that of usual practice. In many cases, he says, the load capacity of a line can be approximately doubled in this way, and the installation of comparatively inexpensive machines can sometimes take the place of building entire duplicate transmission lines. The matter is discussed from a thoroughly practical point of view, and methods of calculation applicable to the design of such systems are given.

Electric Railway Handbook. By A. S. Richez, assisted by W. C. Greenough. 882 pp. 6*½* in. by 4*½* in. 654 figures. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 17s. net.

A wide range of matters connected with electric railway and tramway work is dealt with in conveniently concise form in this handbook. The information relates almost entirely to American practice, but in traction, more than some other branches of electrical engineering, much of the earlier work over here was founded on Transatlantic precedent, and parallel development has taken place, so that this fact is not the same bar to the utility of the volume to British engineers as it might be if other branches of electrical engineering were dealt with. Some of the tables may be found a little inconvenient on account of the use of a different wire gauge; but as a work of reference of modern practice, with none of the obsolete and redundant matter which disfigures so many handbooks, the work should prove of value.

Alternating-current Work. By W. P. Maycock. 415 pp. 7*½* in. by 5 in. 258 figures. (London: Whittaker & Co.) 6s. net; abroad, 6s. 6d.

In this work we have nominally a revised edition of the author's earlier book on "The Alternating-current Circuit and

Motor," prepared with the assistance of Mr. E. Hughes, but to a large extent we have a practically new book. It is intended for the student of limited mathematical attainments already familiar with continuous-current working, and explains the elementary theory of alternating currents partly by the aid of mechanical analogy in simple language. Power measurement is dealt with at some length, and succeeding chapters treat from a practical point of view of alternators, transformers, motors, &c., and their applications. The sets of questions at the end of each chapter will be helpful to students in mastering the contents of the book.

Single-phase Electric Railways. By E. Austin. 803 pp. 11*½* in. by 7*½* in. 346 figures. (London: Constable & Co., Ltd.) 21s. net; British Colonies, 22s. 4d.; other countries, 21s. carriage forward.

This volume contains a collection of excellently illustrated descriptions of the equipment of all the most important single-phase railways in England, the Continent, and America, going into considerable detail as regard both rolling stock and overhead construction. Most of these descriptions, which deal in all with twenty-three different railways, are reprinted from our contemporary, the *Engineer*. The object is to record work actually done rather than to enter into the controversy between the systems or to discuss the trend of future development, although in his introduction the author shows himself a believer in the single-phase system wherever there is a possibility of running heavy trains long distances.

Dielectric Phenomena of High-voltage Engineering. By F. W. Peck. 265 pp. 9*½* in. by 6*½* in. 190 figures. (New York: McGraw-Hill Book Co.; London: Hill Publishing Co., Ltd.) 12s. 6d. net.

With the greatly increased voltages now used on transmission lines in America and elsewhere, the study of the action of high-pressure on the dielectric has become of considerable practical importance. The author treats the whole question in a comprehensive way, investigates more especially the conditions for and nature of corona losses and the losses caused thereby, the conditions for sparking over, and the properties of different insulation materials. The final chapters deal with the practical design of transmission lines from these points of view, and a brief review of the electron theory is also included.

Arithmetic of Alternating Currents. By E. H. Crapper. 208 pp. 7*½* in. by 5 in. 45 figures. (London: Whittaker & Co.) 2s. 6d. net; by post, 2s. 8d.

This is intended to be used as a companion to the larger text-books on alternating-current working, and recapitulates the most generally required methods of alternating-current calculation, providing a series of graduated exercises such as should be of great assistance to the student in obtaining the practice and familiarity with the subject which is essential to a thorough insight into the principles. The whole is well arranged, the methods are explained clearly, and the diagrams throughout are admirable.

The Rare Earth Industry, including the manufacture of incandescent mantles, pyrophoric alloys, and electrical glow lamps, by S. J. Johnstone. Together with a chapter on the industry of radioactive substances, by A. S. Russell. 136 pp. 10 in. by 6*½* in. 42 figures. (London: Crosby, Lockwood & Son.) 7s. 6d. net; abroad, 8s. 1d.

The author has collected together a great deal of information as to the occurrence, preparation, and industrial uses of the metals, and their compounds, obtained from the group of minerals known as the rare earths, and other elements of more or less limited occurrence. It is a book of reference for industrial chemists, lamp manufacturers, experts, patent lawyers, &c., and covers a considerable amount of ground. The subject divides itself into the following main headings:—The Thorium and Cerium industry, including gas-mantle manufacture and pyrophoric alloys, Titanium, Zirconium, Tantalum, Niobium, and Tungsten. The last leads us to a chapter on the incandescent electric lamp manufacture, which is necessarily somewhat brief, but is up to date. Chapters follow on uranium and vanadium, and the final section of the book, from the pen of Dr. Alexander Russell, deals with the industry of the radioactive substances. The utility of the volume is much enhanced by the bibliography and references which head each chapter, and throughout the text there are numerous references to the multitude of patent specifications which are of such advantage to some connected with these industries, and such an obstacle to others.

Electricity for the Farm.—By F. J. Anderson. 265 pp., 7*½* in. by 5*½* in., 49 figures. (New York: The Macmillan Co.; London: Macmillan & Co., Ltd.) 5s. 6d. net; abroad, 6s. THE title of this book might lead the English reader, at any

rate, to expect the work to be a treatise on the special applications of electricity to farming operations, and if so he will be disappointed. The book is an incitement to the American farmer to utilise any water power he may have on his estate to work an electric lighting plant, and it gives him simple and elementary instructions how to fit up such a plant and how to wire his farmhouse. In addition there is a short chapter on "gasoline" engine plants. As in this country the distances of farms from the nearest towns are not great, the farmer here will be better advised to employ an electrical contractor to wire his house and erect his plant, and should not undertake the job with his own hands.

A B C of Electricity. By W. H. Meadowcroft. 127 pp. 6*1*/₂ in. by 4*1*/₂ in. 38 figures. (London : Harper & Bros.) New edition. 2s. net; by post, 2s. 3d.

This is a little elementary work, the object of which is to explain to young people some of the main facts about electricity and magnetism, and the way in which they are applied in telegraphy, wireless telegraphy, telephony, electric light and power, and the action of primary and secondary batteries. Although the text has been partly re-written since an earlier edition, some illustrations have been retained which, although of historic value, have no utility as examples to help in the understanding of present-day apparatus. For example, an Edison "Jumbo" machine of 1881 forms the frontispiece.

Modern Boiler Room Practice and Smoke Abatement. By J. T. Hodgson. 321 pp., 8*1*/₂ in. by 5*1*/₂ in. 209 figures. (London : "The Railway Engineer.") 3s. 6d. net; abroad, 4s.

This is a thoroughly practical manual of modern boiler-house practice dealing with the various factors which influence efficiency in working, and giving particular attention to the causes which lead to emission of smoke and the cure of this disease, a matter intimately linked up with the economical production of steam. The whole subject is one that has made great advances of late years, and it is largely due to systematised study, such as is dealt with in this book, having taken the place of the old rule of thumb methods that economies are attainable to-day that would have been impossible a few years ago.

Alignment Charts: Their Principle and Application to Engineering Formulae. By E. S. Andrews. 32 pp. 7*1*/₂ in. by 4*1*/₂ in. 11 figures. (London : Chapman & Hall, Ltd.) 1s. 3d. net; by post, 1s. 4d.

The alignment chart in its simplest form is a graphical method of obtaining results according to simple formulæ, depending on the use of suitable three-graduated vertical scales representing the variables intersected by straight lines drawn through values of two known variables in any particular case, and indicating the value of the unknown variable at its point of intersection with the third scale. There are many engineering calculations that can be made by the method, which is fully explained in this little handbook.

A Treatise on Hand Lettering for Engineers, Architects, Surveyors, and Students of Mechanical Drawing. By W. J. Lineham. 282 pp. 12*1*/₂ in. by 8*1*/₂ in. 117 plates. (London : Chapman & Hall, Ltd.) 7s. 6d. net; abroad, 8s. 8d.

The art of hand lettering on drawings is one requiring far more care and study than is usually appreciated if first-class results are to be obtained, and this is, so far as we know, the most complete treatise that has been published on the subject. Addressed principally to engineering and architectural draughtsmen, the work contains useful hints and instructions, and a comprehensive series of large plates presenting examples of different classes of lettering. An outline is given of the usual process of zinc block making, accompanied by a few remarks relating to drawing for reproduction.

Handbook of Patent Law of all Countries. By W. P. Thompson. 242 pp. 6*1*/₂ in. by 4*1*/₂ in. (London : Stevens & Sons, Ltd.) 16th edition. 2s. 6d. net; by post, 2s. 9d.

The very convenient little handbook of patent law and practice has been thoroughly brought up to date and contains summarised information as to the conditions under which patents are granted according to the laws in force in all parts of the world. It has not been thought necessary to give at any length the temporary arrangements in force regarding the belligerent countries, as these are continually being altered, and nearly all the Governments concerned have made provision for patents lost through the exigencies of hostilities being made good after the war. A special feature of the work is the completeness of the foreign sections.

The Slide Rule. By C. N. Pickworth. 122 pp. 7*1*/₂ in. by 5 in. 37 figures. (Manchester : Emmott & Co., Ltd.) Thirteenth edition. 2s. net; by post, 2s. 3d.

Mr. Pickworth's excellent little manual on the slide rule is

too well known to need any introduction to our readers. The thirteenth edition now before us has been carefully revised, and a method of obtaining fifth roots, &c., has been added, together with descriptions of new forms of slide rules and calculators, making the work even more complete than it was before.

Russian Self-taught with Phonetic Pronunciation. By Capt. C. A. Thimm and J. Marshall. 134 pp. 7*1*/₂ in. by 4*1*/₂ in. (London : E. Marlborough and Co.) Fifth edition. Paper covers, 2s.; by post, 2s. 2d. Cloth, 2s. 6d.; by post, 2s. 8d.

In these days many persons in all professions are finding the need for a certain amount of knowledge of Russian, and will receive with interest an introduction to the language such as this, which, if it does not go very far towards a real knowledge of its manifold intricacies, will at any rate enable the student who masters it to become familiar with the alphabet and acquire some useful travelling phrases and vocabulary with some degree of approximation to their true pronunciation.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Wireless Telegraphy with Moving Trains

Experiments with wireless telephone communication with moving trains on the Delaware, Lackawanna, and Western Railway in America are leading to very promising results. A special fixed station has been established at Binghamton for both transmission and reception, and, according to the *Electrical World*, an equipment is provided on board the train comprising a complete transmitter, receiver and amplifier. Steam at from 80 lb. to 120 lb. per square inch is led to the baggage car directly behind the locomotive, and fed to a Terry 5-h.p., 2,500-r.p.m. turbine directly connected to a seventy-two-pole 3,000-cycle-per-second inductor alternator. Field and armature circuits of the 3,000-cycle alternator are carried to the next car in the rear, where the radio apparatus is installed. From these instruments wires run to ground, via the car wheels, and to an antenna consisting of three parallel wires run along the roofs of four adjacent cars and flexibly connected. The apparatus is on the De Forest system. For transmission, the 3,000-cycle current is led serially through a line condenser and the primary of power transformer, the secondary of which is connected directly across three very short tungsten electrode spark-gaps in series. Across the spark-gaps are connected an air condenser and a variable spiral inductance, which determine the wave-length of transmission. Inductively coupled to the spiral inductance is the secondary spiral, also variable, which has one terminal connected to the antenna and the other to earth through two Berliner microphones in series. The receiving apparatus includes a two-circuit tuner and an audion detector in conjunction with a three-step audion amplifier.

The fixed station contains similar apparatus with a motor-driven alternator, but the amplifier is not found necessary. Telephonic communication has been carried on at fifty miles' distance, although there is some degree of irregularity in the working at present, which it is hoped that further experiments will remove. There is no difficulty, however, in maintaining communication by Morse signalling. The Company also use wireless telegraphy to a considerable extent to supplement line communication and to take its place in emergency.

ELECTRIC TRACTION NOTES

The Annual Conference of the Municipal Tramways Association was held in London on Thursday and Friday last week. Alderman H. Linsley, Chairman of the Salford Corporation Tramways Committee, in his Presidential Address, gave a general review of the work carried out by the Council during the year, and mentioned, among other things, that close consideration is still being given to the vexed question of the allocation of the burden of road main-

tenance as between the various classes of road users, and that in many matters of importance, conferences have been held between the representatives of other associations whose interests are allied to this Tramways Association. Matters so dealt with include defects in tramcar controllers, electric vehicles, and interest on tramway funds. After pointing out that 16,000 tramway employees, or 30 per cent. of the Municipal Tramway employees in the country have joined the colours, reference was made to the reductions of income which many tramway undertakings have had to sustain, and the aggregate figure to-day was put at £380,000 in municipal undertakings alone.

Among the papers read at the meeting was one by Mr. Alfred Baker, General Manager of the Birmingham Corporation Tramways, upon "Financial Problems as Affecting Tramway Undertakings during the War." The Birmingham Corporation, unlike the majority of other tramway undertakings, has taken the step of increasing its fares in order to meet the peculiar position created by the war. It is admitted that the revenue of the Birmingham tramways remained more or less steady, notwithstanding the war, but the various increases in cost of working, such as allowances to employees who have joined the Forces, and the increased price of materials, is held as a justification for higher fares which have brought in additional revenue to the extent of £70,000 or £80,000. The following figures of increases in cost of tramway material are interesting:—Iron and steel bars, 60 per cent.; trolley wire, 30 per cent.; steel tyres, 80 per cent.; and trolley wheels, 10 per cent. In the course of the discussion which followed, there was some difference of opinion as to the advisability of increasing fares, and the

opinions of many managers of the larger undertakings where revenue has remained constant or, probably, has increased during the war, were against this action.

Mr. Peter Fisher, General Manager of the Dundee Corporation Tramways, has been elected President of the Municipal Tramways Association for the coming year.

The Bristol Corporation is still negotiating with the Bristol Tramways & Carriage Co. as to the taking over of the Company's undertaking in accordance with the Act of last year. The Corporation has an option which expires on October 31st this year, and the negotiations at present are on the basis of the concessions which the Company will make to the Corporation in the event of the latter refraining from exercising its option of purchase for a period of 7, 14, or 21 years. In the meantime the Treasury has been approached with a view to ascertaining whether consent would be given to the raising of the necessary capital in the event of the immediate purchase of the Company's undertaking being decided upon. The Treasury, however, has replied that it was not considered to be in the public interest to do this at the moment. Having regard to this fact, it is proposed to apply to the Board of Trade for permission to extend for another twelve months the period within which the Corporation may exercise its option to purchase.

The "Cedes" Electric Traction, Ltd., has received instructions from the Hove Corporation to remove the overhead trolley omnibus equipment which was erected for experimental purposes. As we have already indicated, the Brighton and Hove Corporations have agreed to postpone any further action in this matter until after the war. The Company is to be paid £600 as agreed as out-of-pocket expenses.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 23rd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

19,191/14. **Lampholders.** ST. HELEN'S CABLE & RUBBER CO. and J. C. WHITE. Corrosion-proof lampholders not requiring well glasses, in which the conductors pass through a sealing compound within the holder and the metal cap of the lamp is covered in. (Three figures.)

19,322/14. **Electric Reciprocating Tools.** J. W. MACKENZIE (International Electric Tool Co., U.S.A.). Electric hammers, &c., in which the reciprocating plunger is actuated by two solenoids. Both solenoids are supplied with a permanent continuous current, and also by means of separate terminals with an alternating current, which reinforces the field of one and neutralises the field of the other, so that the solenoids at each end are energised alternately. The continuous and alternating currents are obtained from a special generator provided with both commutator and slip-rings. (Five figures.)

2,490/15. **Motor-starters.** W. J. SHEPPARD and A. YARWOOD. Contactors for the control of resistances in automatic starters actuated by the rise of the back E.M.F. arranged to keep the control-circuit of the main contractor open at all times, except when the whole of the resistance is in circuit. (Five figures.)

8,189/15. **Accumulator-cases for Motor Vehicles.** P. A. H. MOSSAY. The cases are in the form of drawers on each side of the chassis, which can be let down on to rollers and slid out sideways. (Four figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Electrometallurgy and Electrochemistry: BRÜSTLEIN [Lining of electric furnaces] 19,809/14; MEIGS [Electrical apparatus for effecting the combination of gases] 982/14.

Switchgear, Fuses, and Fittings: HOPE [Fuses] 24,368/14; W. & T. AVERY, LTD., and GIBBS [Switch for use with weighing scales] 1,113/15; R. BOSCH [Pedal switch] 2,236/15; IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co.) [Controllers] 3,283/15; SHORT [Switchfuse] 6,196/15.

Telephony and Telegraphy: HAMMOND [Wireless control] 16,328/14; THOMPSON (Soc. Anon. des Telegraphes E. Belin)

[Synchronising apparatus] 20,908/14; IMRAY (Siemens & Halske A.G.) [Selectors] 498 and 3,565/15.

Miscellaneous: WALKER [Magnetic clutches] 21,354/14; HEINSOHN [Electric welding] 2,248/14; WILKINSON [Electric drilling machines] 3,997/15; LILIENTHAL [X-rays] 4,097/14.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Miscellaneous: F. KRUPP A.G. [Electric signalling or distant controlling plant] 12,614/15.

Opposition to Grant of Patents

Opposition has been entered to the grant of patents on the following specifications:

17,133/14. **Electrometallurgy.** T. R. HARRIS. Improvements in the electro-deposition of metal upon metal by means of high-current density, specially applicable for coating printing rollers, hydraulic rams, &c., with a revolving cathode and a sprayed electrolyte.

2,767/15. **Electrodes.** SIEMENS & HALSKE A.G. Electrodes for electrolytic purposes made from manganese peroxide.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

19,811/01. **Cable-testing.** E. A. CLAREMONT. A special design of closed tank for the testing of lead-covered cable in water under pressure.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS and TRANSFORMERS: SIEMENS BROTHERS & CO., LTD. (Siemens & Halske A.G.) [Motor control] 12,983/03; SIEMENS BROTHERS DYNAMO WORKS, LTD., and M. KLOSS [Alternator armature windings] 12,390/08; B.T.-H. (G.E. Co., U.S.A.) [Starting of A.C. motor] 13,285/06 and [Prevention of sparking in A.C. motors] 12,580/08.

Storage Batteries: H. C. HUBBELL [Battery plates] 11,862/05.

Switchgear, Fuses and Fittings: W. FAIRWEATHER (Benjamin Electric Co.) [Wireless cluster fittings] 12,998/06; B. T.-H. CO. (G.E. Co., U.S.A.) [Motor starters] 13,222/06.

Telephony and Telegraphy: W.AITKEN [Telephone indicators] 13,312/06.

Traction: B. T.-H. CO. (G.E. Co.) [Electric railway system with H.T. supply converted on the train] 13,287/06.

Miscellaneous: G. C. LARSSON [Mercury interruptor] 13,278/07; A. CLARKE [Projector lamp on Nernst principle] 13,391/09; H. J. HERBERTS [Electromagnetic advertising device] 13,740/09.

CATALOGUES, PAMPHLETS, &c., RECEIVED

ELECTRICAL PLANT AND CONTRACTING.—Dick Kerr & Co., Ltd. (Abchurch Yard, Cannon Street, E.C.) have issued a very fine illustrated book dealing in a general manner with their manufacturing plant, and giving interesting particulars of many important contracts in various branches of engineering which they have carried out. In view of the accusations of lack of enterprise sometimes made against British manufacturers it is very pleasant to see so comprehensive a record of work carried out by a purely British concern. The pages of the book, besides giving descriptions of the Preston and Kilmarnock works, illustrate many turbo-generators and other items of central station and sub-station plant, electric locomotives, motor coaches, haulage gears, &c. An extensive section deals with tramway construction, and many examples of large contracts in other branches of engineering are described and illustrated. Spanish and Portuguese editions of the work are in course of preparation.

ELECTRIC FIRES.—A very neatly produced catalogue from the Electric Supplies Co. (53 Victoria Street, S.W.), gives prices and particulars of a complete range of electric fires, most of which are fitted with "Qued" heating element already described in *ELECTRICAL ENGINEERING* (July 22nd, page 316). The designs embrace examples of both artistic merit and utilitarian economy, and the variety is such that patterns can be selected to suit all circumstances. Several patterns of the "Ensign" fire are also included, which employs a somewhat differently constructed heating element with solid fire-brick body built into a cast-iron box.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ADJUSTABLE FITTINGS.—A card from Dugdill's Patents (Failsworth, Manchester) illustrates numerous patterns of their well-known adjustable and flexible fittings.

MOTOR-CONTROL PANELS.—A leaflet from the British Thomson-Houston Co. (Rugby), describes some new designs of motor-control panels for motors up to 7½ h.p. A sheet metal base is used on which is mounted an enclosed ironclad D.P. switch-fuse above the starting rheostat.

HOLOPHANE INDUSTRIAL GLASSWARE

THE excellent efficiency of illumination which can be obtained by the scientifically designed prismatic glassware, known by the name of Holophane, has long been recognised, and the range of reflectors made is such that one can always be selected to direct the light in the way required to give the best effect. There are, however, drawbacks to the employment of unprotected glassware for industrial purposes, such as liability to breakage, and to meet these, Holophane, Ltd. (12 Carteret Street, S.W.) have brought out a new series of industrial prismatic reflectors in which aluminium cases are spun over the outsides so as to seal up completely both ends. This metal cover rests on the apices of the prisms, and so far from interfering with the efficiency of reflection even improves it by reflecting back with its own polished surface such rays as escape reflection from the inner surface of the glass. We have thus a reflector of high efficiency which is strong, easy to clean, and not liable to tarnish. The Company has worked out accurate distribution curves for each of the many forms of reflector made and have prepared a series of useful tables by which the proper spacing of lamps of any size in any reflector can be ascertained for any desired degree of illumination.

SWITCHING COMPETITION

THE next of the series of examinations and competitions in electric light switching, conducted by A. P. Lundberg and Sons (477-489 Liverpool Road, N.) is announced for February, 1916. Full particulars and examinations will be published in the form of a pamphlet, which will be posted to all intending competitors, who are requested to send their names and addresses to the firm.

—OUR BOOK— DEPARTMENT.

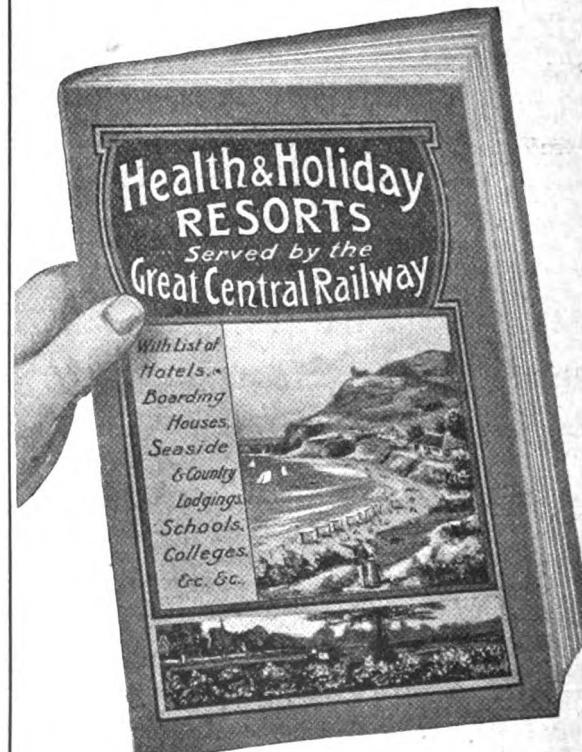
Technical Books by all Publishers sent carriage free to any address in the United Kingdom at net published prices.

Orders should be addressed to the **KILOWATT PUBLISHING CO., LTD.** (Publishers of *Electrical Engineering*), 203, Temple Chambers, London, E.C., and should be accompanied by a remittance.

List of recommended electrical books on application.

BINDING "ELECTRICAL ENGINEERING."—Vol. X. of "Electrical Engineering" (Jan.—Dec. 1914) closed with our issue of December 31st. Readers can have their volumes bound by their own bookbinder; or, they may send their numbers to THE KILOWATT PUBLISHING CO., LTD., TEMPLE CHAMBERS, LONDON, E.C., carriage paid (with the reader's name and address), and a remittance of 4s. 6d. under separate cover. The volumes will then be bound and returned carriage paid to any address in the United Kingdom, or carriage forward to the Colonies or abroad. Binding Cases (including index, but not including binding) 2s. each, or post free 2s. 4d. (Abroad 2s. 6d.) Index alone, 1d. (Post free 2d.).

For your HOLIDAYS



This Guide contains GOOD ADVICE & USEFUL INFORMATION

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SAM FAY, General Manager.

**TENDERS INVITED AND
PROSPECTIVE BUSINESS**

Generating Stations, Sub-Stations, Mains, &c.

Basingstoke.—Extensions to the mains at an estimated cost of £480 are to be carried out.

Bootle. In conjunction with the new boiler plant which is being installed by arrangement with the Ministry of Munitions, it is anticipated that a new turbine will be required shortly.

London: Hammersmith.—Seven 200-kw. transformers are required at an estimated cost of £1,050. These are necessitated by the activity of many factories engaged on war work. In order to supply Regal Films, Ltd., at Ravenscroft Park, mains extensions at an estimated cost of £160 are to be carried out.

New Zealand.—The Dunedin Council requires a 3,000 volt regulator. Further particulars at 73 Basinghall Street, E.C. Tenders by Nov. 3rd.

Pembroke (Ireland).—Tenders are invited for a cooling tower at the electricity works. Clerk, Oct. 3rd.

Plymouth.—Mains extensions are to be carried out at an estimated cost of about £200.

Salford.—The Electricity Department requires 20,000 pairs of non-metal cored flame arc lamp carbons, 15 in. by 8 mm. and 9 mm. respectively. Borough Electrical Engineer. Oct. 4th.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Aberdeen.—Cinematograph theatre.

Dunfermline.—Hippodrome. H. Hare, Opera House, Dunfermline.

Falsworth.—New technical school.

London.—Cinematograph theatre, Rotherhithe. A. Bernstein, Harley Street, Bow, E.

**TENDERS RECEIVED AND ACCEPTED
AND ORDERS PLACED**

Bootle. Acting in conjunction with the Ministry of Munitions, the Electricity Committee has been successful in obtaining from Messrs. Babcock & Wilcox two boilers, which were in course of construction for another body. The contract price is £5,500.

APPOINTMENTS AND PERSONAL NOTES

The late Mr. J. C. Gill, Borough Electrical Engineer at Peterborough, left estate valued at £3,350 with net personalty of £1,895.

**MISCELLANEOUS BUSINESS NOTES AND
TRADE ANNOUNCEMENTS**

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £87 to £88 (last week £86 10s. to £87 10s.).

Change of Address.—Mr. S. G. Brown, of 4 Great Winchester Street, E.C., has removed his offices and works to Edward Road, Willesden Lane, North Acton, W.

**THE
MOST VALUABLE WORK
FOR ELECTRICIANS**

By RANKIN KENNEDY, C.E.

The coupon below entitles any reader of ELECTRICAL ENGINEERING to a complimentary copy of a booklet describing what is probably the most valuable work for electricians ever published. The necessity for electrical engineers being well acquainted with all designs for installations that have given good results will be readily acknowledged by those whom the matter concerns.

While there are numerous text-books dealing with one branch or another of electrical engineering, they are all prepared for the student, and their contents deal rather with theory than with practice.

The aim of the new Edition of "ELECTRICAL INSTALLATIONS" which has just been published is to assist the practical man who is concerned with electrical installations in any form, and this because it is recognised that there exists a very large class engaged in constructive and installation work, and a still larger class whose duty it is to take care of the machinery employed in working by electricity. Most of these men have picked up a working knowledge of their employment. What they need is to study the elements of the science of the subject. These elements are fully dealt with, and on the sound foundation thus laid, the author, who is a civil and electrical engineer by profession, and recognised as being in the front rank of electricians and engineers, proceeds to deal with every possible form of electrical installation, their principles and practical application.

ALL BRANCHES DEALT WITH.

The work includes in its comprehensive scope a review of electrical instruments, with references to indicators and recorders, and alternating wattmeters, electric pyrometers, and an electric spark recorder—all of supreme importance to electricians and electrical engineers. The heavy branch of electrical engineering, dynamos, motors, alternators, transformers, are, needless to say, given in great detail and with profuse illustrations. A section is devoted to the electric ignition and electric illumination on motor-cars. Herein will be found up-to-date information on magnetos for ignition and "constant current at variable speed," and dynamo electric generators.

Dual ignition systems are fully dealt with, so, too, are "electrical installation accessories," wiring switches, switchboards, regulators, electrical signals, telegraphs, telephones, and wireless telegraphy.

Electrical appliances in workshops, factories and steamships are now more numerous, and are daily becoming more commonly in use in every department of commercial industry; hence it is more and more necessary that mechanics, fitters, plumbers, engineers-in-charge, marine engineers and others should have an intelligent knowledge of the subjects given in this work—a knowledge which, added to his trade training, makes a man valuable far beyond the mere tradesman.

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Please send me, free of charge, and without any obligation on my part, Illustrated Booklet on the Book of ELECTRICAL INSTALLATIONS and particulars of your plan whereby the volumes are delivered for a first payment of 1s. 6d., the balance being paid in small monthly instalments.

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LOCAL NOTES

Ayr: *Electricity Profits.*—There was a net profit of £1,248 on the past year's working of the electricity undertaking compared with £1,450 in the previous twelve months. Of this sum, £1,196 is used to scrap certain out-of-date plant, and the balance is to be placed to reserve account, which now stands at £5,351. New generating plant should have been installed, but it has not yet been delivered, and is not expected now for some time owing to the war. When, however, it is installed, the higher efficiency, it is estimated, will go a long way towards counterbalancing the increase which is taking place in the price of coal and other materials.

Bootle: *Plant Extensions.*—The large demands upon the Electricity Department by firms engaged on capital contracts has had the effect of rendering it necessary to consider the installation of new machinery. A short time ago the electricity works were inspected on behalf of the Ministry of Munitions, and instructions were given that the factories were to be supplied even if it meant disconnecting the tramways and private consumers. The demands, however, have now reached such a point that it is absolutely necessary to instal new plant. For the moment the position can be met by the addition of two new boilers in the boilerhouse.

Grimsby: *Electricity Charges.*—A new scale of charges for all purposes is being introduced, which has the effect of increasing the previous charges by 6 per cent. all round. This is estimated to bring in £1,000 additional revenue, and the Committee is satisfied with this, notwithstanding suggestions that the increase should be 10 or 12½ per cent., in conformity with what is being done in many other districts.

Ipswich: *Electricity Accounts.*—The Engineer's report for the year to March 31st, 1915, shows that there has had to be a call on the reserve fund for £857. A number of special items easily explain the position. The period in question has had to bear £550 additional capital charges, all concerned with the expenditure upon the large extension scheme for supplying the eastern district without the benefit of additional revenue from that expenditure. This has been due to the difficulty of obtaining the necessary plant, and also to the fact that some of the mains which were being manufactured in France fell into the hands of the Germans at the beginning of the war. In addition, no less than £1,199 has been paid out of revenue on purely capital items, for which at present the Local Government Board will not grant loans, and a further £200 represents allowances paid to employees who have enlisted. The output for both lighting and power has been seriously affected by the war, and also by the order as to the obscuring of public lights and shop lamps.

London: *Battersea, Fulham, and Hammersmith.*—On page 325 of our issue for July 29th we mentioned that the Treasury would only consent to loans being taken up by Battersea and Fulham in connection with the proposed linking-up scheme between Battersea, Fulham, and Hammersmith. The Hammersmith Council has been in communication with the Treasury direct in order that permission may be granted to it taking part in the scheme, and it is understood that the London County Council has made arrangements for the Hammersmith application to be reconsidered at the first meeting after the recess. It is for these reasons that the Hammersmith Council has not yet sealed the agreement with the other two authorities, as recently pointed out in our columns.

Hackney: *Anticipated Deficit.*—The Electricity Committee reports that whereas at the beginning of the year a surplus of £30 was estimated upon the working of the Electricity Department for the current year, figures now placed before the Committee show that a considerable loss on the year's working will occur. After considering the best means to be adopted for meeting this deficiency, it has been decided that, having regard to the low cost of energy in the borough,

the most equitable arrangement to all classes of users will be to increase the existing scale of charges by 10 per cent. all round.

Loughborough: *Increased Charges.*—The Council has decided to increase the charges for supply by 12½ per cent., the reasons given being increases of 50 per cent. in the price of coal, and 23 per cent. in wages. There will, however, be a discount of 5 per cent. on all the accounts paid not later than the 21st day of the month following each quarter day. The increase also applies to slot meter users.

Newcastle-on-Tyne: *Reduced Prices and Apparatus on Hire.*—In contradistinction from many other electric supply authorities, the Newcastle-on-Tyne Electric Supply Co. has reduced its charges for electricity, for heating and cooking, and has also devised a scheme for hiring out apparatus upon reasonable terms. This is an attempt towards increasing the use of electricity for household uses, which might well be copied elsewhere.

Newquay: *Proposed Increase of Maximum Price.*—It has been the practice of the Board of Trade for some years to fix the maximum price in electric lighting orders at 6d. per unit instead of 8d. per unit, which was the figure originally. The Newport Electric Light & Power Co., which has a maximum of 6d. in its electric lighting provisional order, has petitioned the Board of Trade to increase it to 8d. Considerable opposition is being shown to the proposal, it being pointed out that if the Company, when it first came into the district with its scheme, had proposed that it should have a maximum price of 8d., few of the present consumers would have gone to the expense of wiring their premises for electric lighting. A petition has been sent to the Board of Trade in which it is asked that, should it be deemed advisable to grant the increase, it should be limited to the period of the war. A strong protest, however, is made against any increase.

Salford: *Satisfactory Electricity Accounts.*—For the year to March 31st, 1915, there was a net profit of £8,406, which has been transferred to depreciation and renewals account, which now stands at £21,631. The units sold for all purposes were 5 per cent. over the quantity in the previous twelve months. There was, however, a slight reduction in the case of traction, but the increase in lighting and power more than counterbalances this. The Borough Electrical Engineer's report points out that during the earlier part of the financial year a considerable amount of energy was purchased in bulk from the Lancashire Electric Power Co., but since the starting of the new turbo-generator (ELECTRICAL ENGINEERING, Vol. X., Dec. 10th, 1914, p. 629), it has been found more economical to utilise the Department's own plant to its fullest capacity. By running the new generating set continuously day and night a reduction has been effected in the fuel consumed equal to 33 per cent. per unit generated. The fuel cost is now down to 0·2d. per unit generated. Apart from the standing charge per kilowatt, the cost of purchased energy is 0·25d. per unit at the boundary substation, to which must be added transforming losses, and as the purchase of energy makes no appreciable reduction in the running costs other than fuel costs, the course pursued is undoubtedly the most economical under present conditions. The minimum standing charge of £3,000 per annum which has to be paid to the Power Company must therefore, says Mr. Robertson, be regarded meantime as a charge to furnish a standby supply equal to 1,000 kw. of plant capacity at the works.

COMPANIES' DIVIDENDS, REPORTS,
MEETINGS, &c.

County of London Electric Supply Co.—Subscriptions are being invited in connection with the Lower Thames Land Development & Power Co. Some time ago the County of London Company obtained an option of 300 acres of land at Barking for the erection of a new power station, no doubt in connection with anticipated developments in power supply for London, but will only require a certain portion for this purpose. The option on the whole area, however, is to be exercised, and subscriptions are being asked to an issue of £80,000 5½ per cent. 25-year first mortgage bearer debentures. The County of London Co. guarantees to provide a sinking fund to redeem the entire issue by October 1st, 1940.

Westinghouse Co.—A quarterly dividend of 1½ per cent. has been declared on the preferred shares, and 1½ per cent. on the common stock.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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SUMMARY

WE publish an interesting communicated article on the effect of enlistment and munition working on the electricity works of a large industrial district. Our correspondent describes the way in which the various problems were solved with satisfactory results to all concerned. He also investigates what will be the best policy to pursue after the war in order that the extensions now made for temporary purposes may be put to good use (p. 404).

THE Guaranteed Wiring Scheme of the Electrical Contractors' Association has been objected to by the Board of Trade (p. 405).

WE discuss the new reduced lighting regulations which now apply to London (p. 405).

THERE were four electrical mining fatalities underground and four on the surface last year; 19 persons were injured underground, and 17 on the surface in non-fatal electrical accidents (p. 406).

PARTICULARS of the extent to which electricity is employed in mines, &c., are also contained in the reports of the divisional inspectors (p. 406).

AN official report refers to the growing use of electricity in the New South Wales mines (p. 407).

A SHORT article refers to the present position in the coal-mining industry (p. 407).

PATENT specifications on mining telephones, control of electric winding gear, lamp unlocking apparatus, and also some of electrometallurgical interest were published during the past month (p. 407).

OUR Questions & Answers page describes the design and lay-out of a telephone installation for mines (p. 408).

AMONG the specifications published by the Patent Office last Thursday were one for an improved magnetic clutch, and a new form of furnace for fixation of nitrogen depending on wipe sparks. Patents for glass-ware and alternator cooling are opposed (p. 409).

A PAPER was read before the Society of Engineers on Monday dealing with some points of contact between law and engineering (p. 409).

WIRELESS telephony over a distance of 2,000 miles has been accomplished by the U.S. Navy (p. 409).

SHORT articles describe an indirect lighting installation, a new switch, a case of lamp strength, and a Red Cross van (p. 410).

H.T. CABLES, transformers and switchgear are required at Littleborough; mains at Watford and Dublin; three-phase transformers with switchgear at Sydney (N.S.W.); mains and services at Darwen; and air-cooled static transformers at Hammersmith.—New plant will be shortly required at Aberdeen and Pretoria.—An inquiry comes from British Columbia for half-watt lamps, and the L.C.C. Asylums Committee requires a supply of electric lamps (p. 411).

THE Newcastle-on-Tyne Electric Supply Co. has devised two interesting new tariffs.—Employees of electrical firms engaged on munition work have been fined at Belfast and Dublin for absenting themselves.—The Glasgow electricity showrooms which have been fitted up by the Electricity Department, in conjunction with local wiring contractors, have been opened (p. 412).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDANT.

Drills, 6.30 to 7.30; 7.30 to 8.30.

(To-day) Thurs., Oct. 7th: Section III., technical. Section II., shooting.

Fri., Oct. 8th: Section IV., technical. Section II., squad, signalling class.

Sat., Oct. 9th: Company parade, 2.30 p.m. Route march.

Mon., Oct. 11th: Section I., technical. Section III., squad, signalling class.

Tues., Oct. 12th: Section II., technical. Section IV., shooting.

Thurs., Oct. 14th: Section III., technical. Section I., shooting.

Fri., Oct. 15th: Section IV., technical. Section II., squad, signalling class.

The Headquarters are at Marconi House, Strand, W.C. (Tel : City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Mr. C. G. Spiers has been appointed Acting Company Sergeant-Major, vice H. N. Fullarton resigned.

In consequence of the great Recruiting March Out on Saturday, October 2nd, the Route March arranged for that day was postponed until Saturday, October 9th.

Members who have not yet been measured for their uniforms are requested to give notice to their Section Commanders when they will be able to attend for measurement, so that an appointment can be made with the tailors.

The work in connection with the new headquarters at Chester House, Eccleston Place, S.W., has been commenced, and it is proposed that drills shall start there on Oct. 18th.

THE EFFECT OF ENLISTMENT AND MUNITION WORKING ON THE ELECTRICITY WORKS OF A LARGE INDUSTRIAL DISTRICT

[BY AN ELECTRICITY WORKS ENGINEER.]

THE war has affected all large generating stations serving important industrial districts, and a brief account of the difficulties which have had to be solved by the writer may be of interest to other central station engineers. Undoubtedly the effect has been felt most seriously in connection with the staff and workmen.

At the start of the war we lost several of our best men through their being attached to various Territorial Forces; by the time we had been able to fill these vacancies the majority of the younger members of our staff had either actually enlisted or were making arrangements to do so. We then obtained the consent of the War Office to retain the services of any man we really required, and it has been fortunate that we did so; the men we have been able to obtain in order to fill the vacant posts being of a very inferior type in every respect. We have found that the interests of the station have been served most efficiently by granting to our remaining men a fair war bonus, and arranging that they shall have some amount of overtime at rather favourable rates of pay. In addition, we have again called into active work a few old men who had practically been pensioned off after having served the department for many years as drivers, firemen, or labourers.

The district being a heavy engineering centre, every workshop was soon running overtime and night shifts on munition work; the skilled tradesmen in these shops are paid at a special rate in many cases, or have special piecework rates. This fact, coupled with the considerable amount of overtime and week-end working which they are putting in, has resulted in their making about treble an ordinary week's wage. As may be imagined, it has not been without its effect on our own skilled workmen. In order to satisfy our own men we granted a fairly good war bonus, and, being below our proper complement, the men were able to put in a small amount of overtime. This arrangement gave satisfaction for some months, and then discontent and grumbling and demands for a higher rate per hour, or permission to transfer to a munition firm, became the order of the day.

In this matter the writer finds that we are not alone, several generating stations in similar circumstances having been annoyed in the same manner. We resolved, however, to take a firm stand on the matter, refused the proposed increase and also permission for the men to leave. In a few days the men fully realised their position, and also reluctantly admitted that, as several members of the official staff had had to refuse good offers of appointments elsewhere, they were merely taking their share in the common sacrifice.

When this stage was reached, we called the men together and informed them that, in order to give them a somewhat better chance of earning the enhanced wages enjoyed by the men in the ordinary workshops, we had decided to go forward with several minor jobs which had been put on one side owing to the war, and that on this account they would have opportunity for a good deal of week-end work. So far the arrangement has worked well. Had we not shown a firm attitude at first, however, there is no saying when and at what point the demands would have ended.

The chief engineer of a neighbouring electricity works solved the problem in the following rather neat fashion. He had his plant in excellent repair when the war broke out, a fair amount of stand-by plant, and another large set three-parts erected. This left his workshop rather slack; to retain his men he arranged to take in a certain amount of munition work. This has kept his repair staff together, and allowed them to earn a good wage without dragging them out of the department. The same plan has, I believe, been adopted in one or two other towns. The effect on the load has been to increase the power demand by about 28 per cent. This demand, however, has been fairly well distributed throughout the twenty-four hours, so that the only alteration in the shape of the load curve has been to fill up some of the hollows, both overnight and at the week-ends. This has brought the station load factor up from about 22 per cent. to well over 30 per cent., and the problem now is to obtain new plant in time to serve the still increasing load. Owing to the fact that much of the new load and the normal power load are of the same character, the diversity factor has not been affected to any extent.

On one point in the management of the department we are able to congratulate ourselves.

When it became evident, a year or two back, that all

future extensions would be on the three-phase system, we were at first undecided whether to take out some of our old sets to make room for the turbo-alternators or whether to extend the buildings for that purpose. The first policy would have meant that we should have had to supply the three-wire and traction loads through the three-phase plant and the rotary converters. Our D.C. sets were in good condition and really reliable plants; finally we decided that instead of spending our capital in paying off the unredeemed loans on the D.C. plant, we would keep the old sets for a time and lay out our money in buildings.

It has been most fortunate that we did so, as the turbo sets would, under the other policy, have been loaded up to the limit, and it would have been quite impossible to do what we do now, namely, give each turbo set a thorough examination from time to time, and meanwhile supply the three-phase demand through the old D.C. sets and the rotary converters, running inverted. The lighting and general domestic load has been allowed to mark time during the last twelve months; the work in making power connections absorbs the whole of the time of our available labour, and as much material as we can get delivered. In the matter of rising coal prices we are protected by our usual agreement on the matter.

In this district, as in most large industrial districts, there are many large firms who, for one reason or another, prefer to run their own private generating stations. In many of these firms, in normal times, we have only been able to get our supply in for the purpose of week-end and sectional working, and in many cases could not get in at all. To-day the cry is for connections as fast as we can make them; our outside staff and the installation contractors are working week-ends continuously in order to satisfy these demands. The managers of these works have now fully realised that motors can be manufactured and installed much quicker than new generating plant for their own stations can be arranged for; we are hoping that when peace is again restored that we shall keep much of this work solely on the grounds of convenience and handiness.

The traction load has dropped to some extent, as the full service of cars is not being run at the present time.

At the conclusion of the war the central station will probably benefit from the fact that many of the private works' generating stations will require extensive repair and renewals after the long spell of hard work through the war. Capital will not be any too plentiful for this purpose, so that it will probably suit many firms to stick to the outside supply of electricity rather than to lay out capital on their own stations.

Another aspect of the effect of the war on the generating station is given by the supply at a well-known seaside resort managed by an acquaintance of the writer. The load at this place is principally a summer load, and with the exception of a demand for various pleasure grounds on the front, is an evening lighting load. This summer the lighting on the promenade and the majority of that in the side streets has been dispensed with; there is still the load from the "Fun City," but in addition it has been possible to pick up quite a substantial lighting load by giving a supply to a neighbouring military camp. This supply will last right through the winter, and will, in fact, furnish the station with a better winter and all-the-year-round load than it has ever experienced since it started up.

In conclusion comes the consideration of the capital expended in war work extensions and the "after war" position of our own and our Allies' trade. The writer considers it necessary to take these two points together, owing to the fact that if we do not make provision now for the "after war" situation, then our Allies and ourselves will experience an exceedingly grave trade depression, which will hit the central station industry as hard as any other.

Previous to the war trade was booming, and would no doubt have remained good for many years; as an industry the central stations were sharing in the prosperity, and, had the war not happened, it is quite probable that the extensions of plant which we have now made in, say, ten months, would have had to have been made in the course of fifteen months at the outside. It is at this point, however, that the cases cease to run parallel. Personally, the plant of which the writer has charge has been increased by about 30 per cent., and further large increases are necessary, which in the matter of capital cost will be more expensive than plant installed two years ago. Had the war not occurred, the whole of the capital laid out in these extensions would have been kept working year after year on a steadily increasing load, and thus been able to earn a fair rate of interest on the outlay.

Now we are faced with the probability of this enormous addition to our capital expenditure being unable to earn its

standing charges, owing to the plant being idle through bad trade after the war. When peace is restored we shall first require to restock our arsenals with the safe minimum amount of war material. As we are increasing the factories at which such material can be made, it follows that this restocking cannot take long, and then will come a heavy slump in trade unless we act now.

When the restocking is complete there will be literally hundreds of motors and thousands of machine tools thrown on the market; at the same time North-eastern France, Belgium, Russia, and Serbia will need their homes rebuilding and their factories putting in a position to supply their needs once again. They will, however, lack the capital necessary to carry out this work.

Will it not pay us to arrange that this capital shall be found by the British Empire, and that our munition factories shall be swung over to industrial work quicker than they were swung from their previous work to that of munition-making? The use of British capital would keep British factories in full work, and along with this boom the generating stations would be kept busy and able to make a return on their recent heavy capital outlay.

The method of raising the capital should not be difficult; let us consent to be taxed on a war basis for a sufficiently long period until we find the money necessary to put our Allies on their feet again. Capital and industry soon react from country to country, and it would not be long ere our friends would be able to start finding their own capital again, thus relieving us of the burden.

The above may seem a drastic idea, but let us consider the alternative. Bad trade at home, discontent and perhaps serious rioting, and undoubtedly heavy local taxation in the matter of poor law rates. On top of this we should have the galling spectacle of trade, which we might have had, going to America.

Let us make no mistake; if we do not come forward and find the capital to rebuild the towns of our Allies, then America will do so, and will not only capture the immediate trade by doing so, but, by the very act of thus helping those countries, will have them in financial bondage to her for many years. The trade would thus go past us to them, and we should be quite powerless to prevent it doing so. So serious does the position appear to the writer that he would advocate the thorough discussion of some scheme to prevent the indicated trade disaster, which our usual methods will drop us into at the finish of the struggle. Public opinion and public men should be influenced on the matter; above all, the time to start is now.

THE E.C.A. GUARANTEED WIRING SCHEME

Board of Trade Objection

AFTER working for so long on its guaranteed wiring scheme, and at a time when there seemed every possibility of the scheme being put into operation, the Electrical Contractors' Association has received a somewhat unexpected set-back at the hands of the Board of Trade. The facts are set out in the October issue of *The Electrical Contractor*, the official journal of the Association, and from these we gather that the Board of Trade comes into the question through the necessity for amending the Articles of Association to deal with the wiring scheme. These amendments had been duly approved by the Association and had been sent up to the Board of Trade for sanction. It appears, however, that the Board of Trade opposed the new clauses in the Articles of Association on the ground that the guarantee scheme sought to confer a benefit on a section of the installation trade, i.e., upon the members of the Electrical Contractors' Association, and was not intended to confer a benefit on the installation trade as a whole, which, it was contended by the Board of Trade, is the *raison d'être* of the Association. Something of a climax has been brought about by the Board of Trade threatening to revoke the Charter of the Association if the amendments to the Articles of Association are persisted in. In the words of our contemporary, "this leaves the guarantee scheme, at least for the moment, high, dry, and inactive."

The position, of course, is open to a good deal of controversy, inasmuch as it is evident that the Association has, in the past, carried on a good deal of work which was clearly wholly for the benefit of its members, and to which the Board of Trade had not taken exception. We are inclined to agree with the view of the Association that the guaranteed wiring scheme is much more calculated to benefit the installation trade as a whole than many other spheres of action of the Association in the past, if only for the "tone" which the existence of such a scheme as that in contemplation must

introduce into the wiring contracting business, notwithstanding that at first glance it might appear to confer a benefit upon the members of the Association alone. The effect of any such scheme must be to raise the general level of installation work in this country, but for the moment the Association is faced with the position as it is put by the Board of Trade; and a special meeting was held in Leicester yesterday, after we had gone to press, when the whole position came up for discussion.

LONDON LIGHTING

THE new regulations with regard to lighting in London were published on Friday, and came into force immediately. They apply to the whole of the Metropolitan police area and to certain districts outside, representing in all nearly 700 sq. miles. Private houses, railway carriages, and shops are included, the first two mentioned being dealt with by specific regulations for the first time. The regulations aim at carrying out the scheme outlined by Sir John Simon in the House of Commons a fortnight ago, when he stated that the main object it was desired to secure was uniformity in lighting rather than absolute darkness. With this end in view it is provided that bright lights in premises of all descriptions must be shaded or the windows must be screened.

So far as domestic lighting is concerned, it is probable that the majority of consumers will meet the regulations by the proper use of blinds and curtains to their windows. In those cases where it is not convenient to put up blinds or to replace some of the transparent blinds with others of a darker material, a great deal can be done towards diminishing the amount of light thrown through a window by hanging lamps lower and by the use of deeper shades totally obscured on the outside, such as the deep 10" x 5" green and white opal shades. Where Holophane and similar shades are used, their utility will not be impaired by covering with cardboard cones, and these, of course, will prevent the light being transmitted outwards through the glass. We trust, however, that, on the whole, the use of blinds will be resorted to rather than a diminution of light, and that the homes of the people will be kept brightly lighted as hitherto. There has been no "frightfulness" on account of the recent Zeppelin raids, but a reversion from bright and cheerful interiors to dimness might just possibly produce in some homes a moral atmosphere of depression, which would be a slight step in the direction of the general discomfort which the Zeppelin attacks aim at producing.

In the case of shop-window lighting it will be safe to say that the same principles must be followed as those advocated ever since the first reduced lighting orders came into force. It is quite time to discard many of the temporary arrangements in the case of shop lighting, for, of course, it is to be expected that the present reduced lighting order will remain effective until the close of the war.

The enforcement of the new regulations is apparently largely in the hands of the special constables, most of whom have, needless to say, not made a study of illuminating engineering; their instructions and criticisms will therefore frequently have to be received with indulgence and patience, for it must not be forgotten that an error on the side of over-zealousness is a virtue rather than a fault.

ANSWER TO CORRESPONDENT

TRANSFORMER.—You tell us in your letter that a fault developed in a colliery so serious as to soften the insulation of and decentralise a cable capable of taking more than twice the normal load, but that the effect on the cable was not serious enough to break down the insulation resistance, but you do not tell us what you want to know. What is the problem that puzzles you?

A Mazda Lamp Phenomenon.—We are informed by the British Thomson-Houston Co., Ltd., that they received the following letter two or three days after the London Zeppelin raid:—"I learnt a rather interesting fact yesterday which I thought you might like to know, as you might possibly be able to turn it to account. In one of the buildings in — where the Zepp. bombs dropped, everything around was shattered except one Mazda lamp, which remained in solitary glory. I have not been to the building myself to see this great sight, but my informant was one of the directors of Messrs. —, and he was quite sure about it."

Killed in Action.—In the recent lists of casualties we regret to notice the name of Lieut. C. H. Scholey, of the Rifle Brigade, only son of Mr. H. Scholey, of Messrs. Scholey & Co. Lieut. Scholey was apparently killed in the great advance in France, for his death was dated Sept. 26th.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

ELECTRICAL ACCIDENTS IN MINES IN 1914

PART I. of the Annual Report of the Chief Inspector of Mines, for 1914, dealing with divisional statistics, is now published. It appears from the tables of accidents reported that during the year under review there were four separate fatal accidents underground due to electricity (one in Scotland, two in Yorkshire, &c., and one in South Wales), and a like number on the surface (one each in Scotland and the northern district and two in the Yorkshire district). Each of these accidents caused one death. One electrical fatality on the surface involving one death is reported in the case of metalliferous mines, but none underground. No electrical fatalities are reported from quarries. The non-fatal underground accidents in mines amounted to 18 (distributed among the following districts:—Scotland, 3; Northern, 1; York, 3; Lancashire, 3; South Wales, 6; and Midland, 2). These caused injuries to 19 persons, as in one of the South Wales cases two were injured in one accident. Seventeen non-fatal surface accidents, each involving the injury of one person are reported (Scotland, 2; Northern, 3; York, 5; South Wales, 4; Midland, 3). No persons are reported to have been injured in non-fatal accidents in metalliferous mines or in quarries.

It is mentioned in the report that Mr. Robert Nelson, H.M. Electrical Inspector of Mines, is now on active military service, and that Mr. W. E. T. Hartley (Junior Inspector of Mines) is acting as Electrical Inspector in Mr. Nelson's absence in the Scottish and Northern divisions, while Mr. W. J. Charlton (Junior Inspector) has been transferred temporarily from the Northern to the Lancashire, North Wales, and Ireland Divisions, and now acts as Electrical Inspector for the districts not covered by Mr. Hartley.

REPORTS OF THE DIVISIONAL INSPECTORS OF MINES

AGOOD many references to the use of electricity in mines are contained in the reports of the Inspectors of Mines for the different districts for 1914, all of which have now been published. The report for the Yorkshire district has already been dealt with in our columns (*ELECTRICAL ENGINEERING*, Sept. 2nd, p. 362).

Scotland.

The report of Mr. H. Walker (who acted in place of Col. C. L. Robinson, who was serving at the front, and has since been killed in action) for the Scottish district gives the total number of electric coal-cutters in the district as 747 (515 disc, 216 bar, 12 chain, 2 percussive, and 2 rotary heading machines); this is an increase of 37 since the previous year, and compares with 166 compressed air machines.

The accidents due to electrical causes were one fatal and two non-fatal on the surface, and one fatal and three non-fatal underground. The underground fatal case was to a man afterwards found to have had a weak heart, who probably received a shock of about 290 volts three-phase from a fuse-box. One of the non-fatal underground accidents is stated to have been the result of using cables of German manufacture and poor quality. One prosecution for contravention of the electrical regulations turned on the date at which a certain unarmoured cable was removed from one part of a mine to another for use on a haulage road. The cable was held not to be exempt as having been in use before June, 1911, as it was being used for a different purpose.

Three thousand three hundred and sixty-five electric safety lamps are in use in the district, against 1,160 in the previous year. The makes are as follows: Ceag, 1,411; Gray-Sussmann, 85; Oldham, 60; Wolf, 1,791; and Float, 18. The aggregate horse-power of motors used in the 340 electrically-equipped coal mines of the district is given as 106,972 underground, and 30,183 on the surface. The increase on the total over the previous year is 17,516. In the Scottish metalliferous mines motors aggregating 527 h.p. are used, and no electrical accidents are recorded.

Lancashire, North Wales, and Ireland.

The report of Mr. A. D. Nicholson for this district records a diminution in the use of electric coal-cutters from 36 to 34,

while there is a slight increase in the compressed-air machines of which over 300 are in use in the division. As regards accidents, there were none due to electrical causes in Ireland, and only three, none of which were fatal, in the remainder of the area; these only involved slight burns. Among the dangerous occurrences, however, a fire is referred to as having been due to an electric cable.

Two thousand three hundred and ninety-eight electric safety lamps are in use, made up as follows: Oldham, 915; Ceag, 716; Gray-Sussmann, 495; Wolf, 264; and Thomson-Rothwell, 8. The aggregate horse-power of the motors in the 137 electrically-equipped coal mines in the district is 13,117 on the surface, and 22,502 underground.

No electrical accidents are reported in the metalliferous mines where motors aggregating 2,316 h.p. are in use.

South Wales.

It is well known that electrical coal-cutters are still only used very little in South Wales. The figure given in Dr. W. N. Atkinson's report is 44, and of these 38 are for machines. There was one fatal accident attributed to electricity underground, and six non-fatal accidents, involving injury to seven persons. Four persons were also injured by electricity in non-fatal accidents on the surface. The fatality was to an assistant electrician who received a shock while attempting to replace the cover of a 500-volt switch-box without having previously cut off the current. The non-fatal accidents were all slight injuries, mostly caused by irregular or improper manipulation of electrical plant, and one by a faulty cable connection. There were no prosecutions for contravention of the electrical rules.

The electric safety lamps in use in the district are given as 23,066 in number, of the following makes: Bristol, 2; Ceag, 16,057; Float, 99; Gray-Sussmann, 80; Oldham, 5,753; Wolf, 1,033; and Varta, 42. The aggregate horse-power of motors in the 291 electrically-equipped coal mines in the district is 93,832 on the surface (including 16,372 for winding), and 100,443 underground. The totals for the metalliferous mines are 720 h.p. on the surface, and 135 h.p. underground.

Midland and Southern.

Mr. H. Johnstone's report for the Midland and Southern division records the use of 84 electrical coal-cutters (35 disc, 20 bar, and 29 chain), as compared with 139 compressed-air machines, although it is noticeable that the total tons of coal cut by the electrical cutters during the year is slightly in excess of the output of the compressed-air machines. No electrical fatalities are reported in collieries, but there were two non-fatal cases underground, and three on the surface. Of these three were apparently due to carelessness in replacing fuses, and one to an error made in connecting up.

One thousand eight hundred and fifty-six electric safety lamps are in use in the district, of the following makes: Bristol, 29; Ceag, 1,064; Gray-Sussmann, 93; Oldham, 362; Wolf, 306; and Float, 2. The aggregate horse-power of motors in the 131 electrically equipped mines in the division is 12,164 on the surface, and 41,105 underground.

One electrical fatality is reported in the metalliferous mines section. In this case a man was exceeding his instructions in making connections. The horse-power of the electric motors in these mines is 5,835.

Northern District.

Mr. J. R. R. Wilson records an increase from 134 to 156 in the number of electrical coal-cutters at work. They include the following patterns: Disc, 58; bar, 33; chain, 63; and percussive, 2. Compressed air are, however, more used, being 546 in number.

One electrical fatality is recorded on the surface, but none underground. One person, however, was injured in a non-fatal electrical accident underground, and four on the surface. The fatal accident was the unfortunate termination of a practical joke. The report also refers to a prosecution of officials of the Clifton Colliery, Workington, for using an earth cable of less than the size required by the rules, and using an unarmoured cable in certain circumstances. The Bench found that a technical offence had been committed, but did not inflict any further penalty than the payment of costs.

The electric safety lamps in use number 6,987, of the following makes: Bristol, 10; Ceag, 992; Float, 17; Gray-Sussmann, 4,276; Joel-Fors, 38; Oldham, 1,330; Thomson-Rothwell, 2; Wolf, 322. The aggregate horse-power of motors in the 279 electrically-equipped collieries of the district is 78,936 on the surface, and 90,875 underground. The metalliferous mines account for a further 466 on the surface, and 408 underground.

ELECTRICITY IN MINES IN NEW SOUTH WALES

THE annual report for 1914 of the Department of Mines, New South Wales, Australia, does not record in the section devoted to accidents any fatalities due to electrical causes, although two non-fatal electrical accidents are reported underground, and one on the surface, one person having been injured in each case. One was due to a damaged trailing-cable of a coal-cutter. One was a case of burns from a short-circuit caused by careless replacement of a fuse, and the other was due to signal wires being live owing to a mistake in the connections of a transformer.

There are few electric safety lamps in use. Some, however, are on order, but have not been delivered owing to the war. The following types are approved for general use: Bristol, B.A.C., Ceag, Turquand-Kingsway, Gray-Sussmann, Manley & Sandy, Joel-Fors, Oldham, Thomson-Rothwell, Varta and Wolf. Six types for officials and special use are also approved. A table gives details of the electrical equipment of 53 collieries. The installations are mostly of moderate size, only one being as large as 2,000 kw., and of the remainder only six over 500 kw. A.C. is not employed as much as D.C. Electric blasting, signalling, and telephones are in use in the majority of cases. Further references to electrical working are contained in the reports of the district inspectors.

A separate report also appears by Messrs. W. Corin and J. F. Dent, Electrical Inspectors of Mines. From these it appears that 5 out of 11 candidates were awarded certificates of competency as mine electricians, making a total of 86 now on the register, while 49 out of 75 passed the electric motor drivers' examination; at a similar examination relating to metalliferous mines, six candidates passed. Speaking of the electrical accidents already referred to, Mr. Corin remarks that "the case of shock from an electrical coal-cutter points to the advisability of the metal work of these machines being efficiently and continually earthed while they are connected to the mains." This matter, he continues, is being considered in connection with the revision of the rules. Mr. Dent reports considerable increase in electrical working in the New South Wales collieries. The general condition of the installations, he writes, is good, and several managers have provided for the earthing of coal-cutter motors, although the rules at present in force do not insist on this.

THE COAL SUPPLY OUTLOOK

SINCE we discussed in our Mining Section on August 5th (p. 328) the general coal-mining position as it was likely to affect the electrical industry, and particularly in the light of the National Conference between the coal industry and the Government, things have been comparatively quiet, to the extent that the possibility of any further open hostility between the men and the owners has for the moment been avoided. The question of increasing output, however, has been taken a step further, for as the outcome of the hints given at the National Conference that the industry generally will be willing to discuss modifications in the general working conditions, a conference between representatives of the industry and the Home Office took place early in September. This conference was convened by the Coal Organisation Committee. The proceedings at this conference were private, but a statement was issued by the Home Office indicating that considerable differences of opinion still existed between the men and the owners, particularly in regard to any interference with the Eight Hours Act. The point of view of the men would seem to be that this should only be resorted to in the last extremity, and that efforts meanwhile should be made—indeed, they are being made—to secure greater regularity in the attendance of miners at the pits and less absenteeism. The men apparently realised that in taking this attitude they might be jeopardising the nation's supply of coal, for the President of the Miners' Federation, the official notice pointed out, stated that if these efforts failed, the question of suspending the Eight Hours Act would be taken into consideration. That no further conference has been held of sufficient public interest to warrant the issue of an official *résumé* of the proceedings is, perhaps, an indication that an improvement has manifested itself in the desired direction.

Death in a Colliery Power Station.—An inquest was held recently into the death of an apprentice in the power station at Kinglassie Colliery, Fife. The deceased was found lying near some switchboard connecting cables, but the chief electrical engineer of the station failed to find any leakage which could account for a shock. The medical evidence found no other cause of death, and the jury reported that they found no evidence as to the cause of death.

Electric Safety Lamps.—It is reported in the *Standard* that in connection with the introduction of electric safety lamps in a portion of the South Wales coal field that coal-cutters who use them are offered 1d. per ton extra.

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ELECTRICAL MINING AND METALLURGICAL PATENTS OF SEPTEMBER

Mining.

A SELF-CONTAINED portable telephone specially intended for use in mines is described in Specification No. 4,526 of 1914 by A. Dootson.

In Specification No. 17,548 of 1914, the German Siemens-Schuckert Co. describe a controlling arrangement for electric winding and haulage gears, having means for preventing the control lever at any point from being moved at a rate exceeding a predetermined maximum, and positive mechanical means in gear with the motor for automatically returning the lever to the "off" position at the end of the travel.

Improvements in mechanical details of an apparatus for magnetically unlocking miners' lamps form the subject of a specification by O. Oldham, numbered 18,442 of 1914.

A system of combined audible and visual signalling for mines has been patented by H. Green and W. de M. Landon, and is described in Specification No. 18,780 of 1914. Two pairs of relays are employed, whereby the audible and confirmatory visual signals may be given by the on-setter to the engine-man, and the signals are automatically reset by the movement of the engine or by a succeeding signal, while allowing of a fresh signal being given during the wind without such signal being annulled until the engine starts.

Electro-metallurgical.

In Specification No. 19,818/14, B. Schwerin describes a process of magnetic separation of ores from slimes in which there is added to the slimes before separation an electrolyte which loosens the close adhesion of the particles of the substance, so that one component tends to separate out by settlement.

G. Brustlein (Norway), in Specification No. 19,809 of 1914, describes a method of constructing the lining of electric furnaces, consisting of stamping the lining material around the rings of cast steel or other material which are to be used subsequently for heating the furnace, instead of stamping it round a special template.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

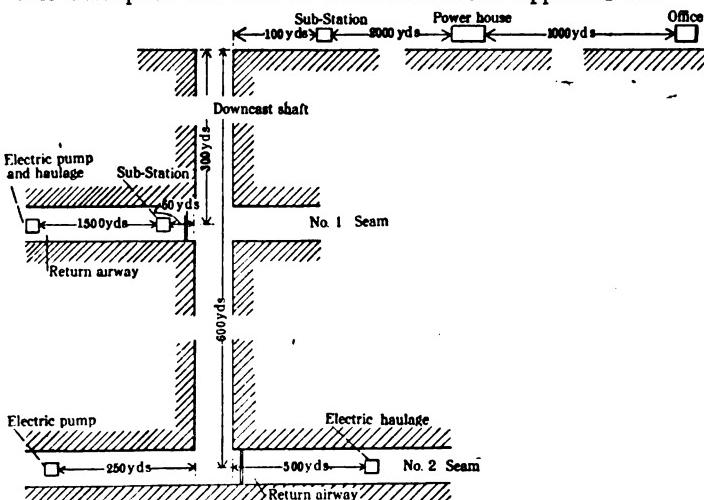
QUESTION No. 1,463.

How are the values of resistances for a controller for a 585 h.p., 485 r.p.m., 2,200-volt, 25-cycle, three-phase slipping induction motor obtained? Rotor star connected, 700 volts, standing 360 amperes full load. The controller to have 12 stops. Is it standard practice to cut resistance first out of B , then R , then Y phase, and repeat until finally short-circuited, or to cut resistance out of all three phases together? If the former method is used, would it have an unbalancing effect on the rotor on any step, and tend to make it hunt, as one phase would be loaded more than the others? How would the resistance be calculated to give any particular speed on any particular step?—RESLETT.

(Replies must be received not later than first post, Thursday, Oct. 14th.)

ANSWERS TO No. 1,461.

In fitting up a new mine with telephone instruments between underground sub-stations and power stations and other surface buildings, what are the factors entering into the problem which require special attention? What would be the most suitable description and sizes of cable and class of apparatus and



general arrangement of circuits to meet the conditions shown on the sketch? The system is to be arranged so that a person could speak to the station or surface office from any other point, or could speak between any two points underground, and must be arranged so that other points about mine can be added later.—"WORKER."

The first award is given to "J. A. M." who writes as follows:—

A central battery system would be most suitable with battery and switchboard at the power station. At sub-stations, office, &c., magneto mining pattern telephones should be installed, these instruments being enclosed in gas and watertight iron cases. Suitable standard instruments can be obtained from any makers of telephones. At each instrument should be fitted a standard instrument protector, consisting of a pair of fuses, heat coils, and carbon block arresters.

Between power-house and office or sub-station on the surface the wires could be 1/18 S.W.G. bare open wires carried overhead on insulators attached to oak cross arms on creosoted wood poles.

Poles on surface: P.O. medium or light size, as given below, planted 5 ft. deep; oak cross arms, $4' \times 2\frac{1}{2}' \times 2\frac{1}{2}'$, each

long enough to carry two pairs of wires with standard P.O. cordeaux insulators on $\frac{1}{2}$ " pins.

From surface sub-stations down shaft and into workings, use 3/22 S.W.G. dry solid paper-insulated and lead-covered cable jute served over lead, then armoured with a layer of galvanised steel wires and jute served and compounded overall. In shaft the cable could be supported by 2-ft. long elm or pitch pine cleats fixed to the buntons, and in the seams it could be carried by canvas or leather suspenders fixed, say, 3 ft. apart hung at the sides of the roads.

Shaft cleats spaced 100 yards apart, the first cleat being placed at the top of the shaft.

A plan giving the following particulars accompanies "J. A. M.'s" reply, and allows for future instruments by including spare pairs in the underground cables. Future wires on the surface where the run is overhead can easily be added at any time as required:—

From office to power-house.—One pair of open wires on 28 ft. P.O. light poles 270 ft. apart.

From power-house to sub-station.—Five pairs of open wires on 28 ft. P.O. medium poles 135 ft. apart.

From sub-station to No. 1 seam.—300 yards 9-pair cable (five spares).

To sub-station, No. 1 seam.—50 yards 4-pair cable.

From No. 1 seam sub-station to pump and haulage.—1,500 yards 2-pair cable (one spare).

From No. 1 to No. 2 seam.—300 yards 4-pair cable (two spares).

To pump in No. 2 seam.—250 yards 2-pair cable (one pair spare).

To haulage in No. 2 seam.—500 yards 2-pair cable (one pair spare).

The second award (5s.) is made to "OAKDENE," who has sent the reply below:—

The first considerations in regard to mining telephones are reliability, strength, and simplicity. First cost, although an important factor, should not be allowed to weigh unduly, because a breakdown in communications in a mine means loss of output, which easily resolves itself into £ s. d.

The simplest method of connecting a system of mine telephones is to arrange them all in parallel, so that there are no switching arrangements, and a call from any one point rings all the bells on the line. If it be thought a nuisance to have bells ringing in the office just because two men want to speak together below ground, then the system can be split up into two parts, and the office section joined up when required by means of a switch, which might with advantage be placed in the power-house. There is a corresponding advantage, however, in having all the 'phones on one line, because when the men below-ground know their conversation can be heard in the office, they are not likely to waste so much time over it.

Agreed that the parallel system is best, what instruments should be used? The parallel system makes too great a demand on the batteries to enable the battery-ringing system to be of use, and, in addition, there is a big expense attached to the maintenance of a large number of cells spread over large areas.

The magneto system is good, but where a large number of telephones are coupled in parallel the generators must be very powerful, and any weakening soon shows up in feeble and intermittent rings. Again, code ringing is practically a necessity when there are a large number of instruments, and code ringing by magneto is not very convenient. Moreover, the magneto handle forms a very convenient coat-hook, which often means the circuit is opened at the generator springs by the strain put on the handle.

The best system is that which employs a main battery of about 24 volts (accumulators are best) above ground, and no batteries at all below. The instruments can be in iron or wood, according to whether they are fixed in dry or wet places. Any number up to forty can be connected in parallel on one line, which consists of a metallic pair and an earth return. The calling is by code, and is done by depressing a push-button at the calling instrument the requisite number of times. This push closes the circuit of a vibrator, which converts the battery current into alternating and rings all the bells. This means no sparking at the bells. Speaking takes place over a metallic pair, the same battery providing the current. The vibrator is with the battery in the office, or other dry place, where it can be got at at once.

The wires should consist of twin 3/22s conductor insulated with pure and vulcanised rubber of 600 megohm grade. It may be armoured or protected against wet if the conditions of the mine demand it. A simple branching joint-box at each 'phone is all that is necessary. The writer knows of at least half a dozen pits in this country equipped in this way, and one of them saves over fifty pounds a year in battery upkeep only.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Sept. 30th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

21,354/14. Magnetic Clutches. M. WALKER. A magnetic clutch having two like members divided on a plane midway and normal to the axis of the magnet and of rotation, and an energising coil fixed into a recess in one member, and projecting into a corresponding recess in the other member, by which both members are simultaneously converted into an electromagnet constructed with a friction ring or face of a non-magnetic material between the exterior pole pieces of the members which prevents contact of the faces and obviates the difficulty of remanent magnetism. (Three figures.)

982/15. Fixation of Nitrogen. C. C. MEIGS. An electric furnace for promoting the chemical combination of gases, comprising an outer shell and a closed shell within the outer shell. Contacts carried on the two shells are arranged to slide upon each other to produce "wipe sparks" on rotation. (Three figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: SAND [Solid metal vapour lamps] 24,766/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: HOLMES and BRIEREY [Watertight junction boxes] 20,687/14.

DYNAMOS, MOTORS AND TRANSFORMERS: SIMPSON [Brush holders] 5,672/15.

Ignition: THOMAS TRANSMISSION, LTD., and THOMAS [Ignition] 2,245/15.

Switchgear, Fusings, and Fittings: SCHASCHKE and SHARP [Lamp holders] 23,534/14; MARICANOLA and TESTA [Push and pull switches] 4,012/14.

Telephony and Telegraphy: BRINKMANN [Contact apparatus for telephone systems] 17,863/14; WESTERN ELECTRIC CO. and MACK [Telephone switching] 21,529/14.

Traction: VIDAL [Train lighting] 19,977/14; MIDGLEY and VANDERVELL [Electric engine starters] 24,293/14.

LAW AND ENGINEERING

BEFORE the Society of Engineers on Monday, Mr. Sydney G. Turner read a Paper in which he referred to a number of points of contact between law and engineering. The old controversy of appointing the engineer on a contract as arbitrator in case of dispute was mentioned, and a quotation was made of the words of Lord Justice Bowen in an action between Jackson v. Barry Railway Co., in 1893, to the effect that in appointing the engineer as arbitrator the parties "rely on his professional honour, his practice, and his intelligence; and the contractor certainly has a right to demand that, whatever views the engineer may have formed he will be ready to listen to argument and at the last moment to determine as fairly as he can, after all has been said and heard." In certain cases, however, the Courts have held that the contractor is entitled to be relieved from the arbitration clause. For example, if the engineer himself is a necessary witness at the inquiry, or if the question in dispute involves a consideration of the engineer's own conduct, it is manifestly unfair that he should act as arbitrator.

As an instance of the difficulties encountered in the electrical industry as regards the breaking up of streets and the laying of mains, the author referred to the recent case of the Charing Cross, West End and City Electricity Supply Co. v. The London Hydraulic Power Co., which was decided in 1913. This was an action brought by the Electricity Supply Co. to recover damages for injury to their cables in four different streets, caused in each case by the bursting of the Hydraulic Co.'s mains. The bursting of the mains was not due to any negligence on the part of the defendants, and the question for decision was whether they were under any liability for nuisance. Two of the mains were laid under a private Act which was silent as to liability for nuisance, but the other two had been laid under a later Act which contained a clause to the effect that nothing in the Act should exempt the Company from liability for nuisance. The later Act further provided that the two Acts should be "read and construed together as one Act."

Miscellaneous: DAWSON and BUCKHAM [Electric signalling apparatus] 14,125/14; A.E.G. [Electric driven charging pump for internal combustion engines] 19,492/14; STERLING TELEPHONE & TELEGRAPH Co. and BARCLAY [Mine signalling] 19,854/14; DAY [Electrical coupling devices] 23,212/14; MIDGLEY and VANDERVELL [Lamp signalling arrangements] 3,002/15.

The following Specification is open to Inspection at the Patent Office before Acceptance, but is not yet published for sale.

Ignition: HENNS, 12,248/15.

Opposition to Grant of Patents

Opposition has been entered to the grant of patents on the following specifications:

10,812/14. **Glassware.** GLASFABRIK & RAFFINERIE J. INWALD A.G. Ribbed and prismatic glass reflectors for incandescent lamps.

10,986/14. **Alternators.** SIR C. A. PARSONS. A method of water cooling the rotors of alternators.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: JOHNSON & PHILLIPS and S. PATERSON [Arc lamps] 12,650/08.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: C. J. BEAVER and C. A. CLAREMONT [Fireproof cable covering] 13,332/04; F. KUHLO [Cable armouring] 13,693/06.

DYNAMOS, MOTORS, and TRANSFORMERS: B.T.-H. CO. (G.E. CO., U.S.A.) [Field magnets] 13,864/04; M. STERN [Control of A.C. motors].

Heating and Cooking: B.T.-H. CO. (G.E. CO., U.S.A.) [Heating elements] 13,961/09.

Incandescent Lamps: B.T.-H. CO. (G.E. CO., U.S.A.) [Filament mountings] 13,590/06.

Switchgear, Fuses, and Fittings: F. T. REID [Time switches] 13,688/07; J. G. MEHNE [Time switches] 14,652/09.

Traction: J. P. TIERNEY [Tramway points] 12,923/08.

Miscellaneous: W. FAIRWEATHER (Brown Hoisting Machinery Co., U.S.A.) [Electric travelling cranes] 13,429/04; J. MCLEAN [Electric hair-brushes, &c.] 13,623/04; SIEMENS BROTHERS & CO., LTD., and F. TURNER [Electric steering gear] 13,567/06; C. A. H., and R. NEWTON [Magnetic separators] 13,845/06; M. SUNDEHEIMER [Burglar alarms] 13,955/09; SIEMENS BROTHERS & CO., LTD. (Siemens and Halske) [Electric signalling] 14,240/09.

It was held that the Hydraulic Co. was liable for nuisance in the case of the two mains laid under the later Act, and further that the effect of the two Acts being read together was to take away any privilege under the earlier Act, and that consequently they were also liable for nuisance in the case of all four mains.

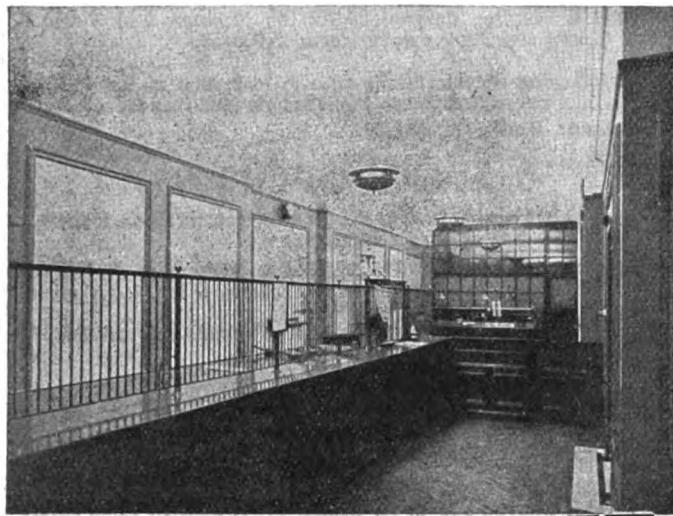
During the course of the discussion, in which several lawyers took part, it was the general feeling that engineers should include, as part of their training, an elementary legal course, in order to acquire the rudiments of the law as it affects their particular branch. There is a possibility of joint meetings between engineers and lawyers being arranged on the lines of the meetings of the Medico-Legal Society.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

According to a Reuter telegram on Thursday last week, the United States Navy Department has successfully experimented with a wireless telephone from Arlington, Virginia, to Mare Island, California, a distance of 2,500 miles. It is stated that the conversation was plainly heard. Successful experiments were also made in telephonic conversation over the regular wire from New York to Arlington, where the conversation was automatically transferred to the wireless apparatus and transmitted to Mare Island instantaneously. A second Reuter telegram adds that, according to officers of the American Telephone & Telegraph Co., wireless communication between the Atlantic seaboard and Honolulu, a distance of 4,600 miles, was accomplished on Wednesday last week. This is in addition to the conversations held under the control of the Naval Department between Arlington and Mare Island.

A LARGE "EYE-REST" LIGHTING INSTALLATION

THE British Thomson-Houston Co. (Rugby) has just completed a lighting installation in which some 120 Mazda "Eye-rest" fittings are employed, in West African House, Kingsway, London. This is a block of offices with a bank on the ground floor, and the illustration of the latter is typical of the other portions of the building. In the bank oxydised silver metal fittings are used, and in the secretary's and agent's offices a single "Eye-rest" fitting with X-ray reflectors has

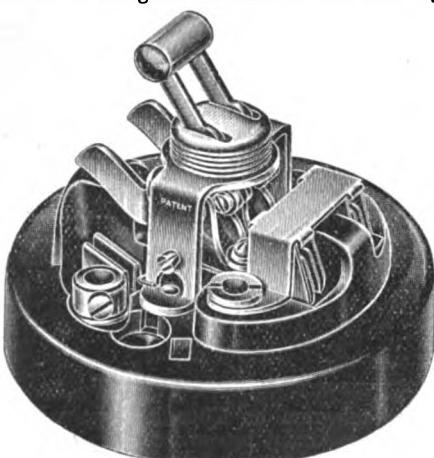


"EYE-REST" FITTING IN MARTIN'S BANK.

been installed. The wiring of West African House was already installed before the details of the illuminating scheme had been determined, and it had been unfortunately arranged that all the lights in each room were turned "on and off by a single switch. To overcome this inflexibility an interesting innovation has been made by providing a three-way pull chain switch in each lighting bowl where required. This pull chain switch constitutes a perfectly unobjectionable addition to the fitting, and permits flexible lighting from each bowl, or permits all the lamps therein to be extinguished, as may be desired.

QUADRUPLE BREAK SINGLE-WAY TUMBLER SWITCHES

MESSRS. A. P. LUNDBERG & SONS (477-489 Liverpool Road, Islington, London), have introduced a new type of single-way tumbler switch with quadruple break, which is designed to obviate the liability of tumbler-switch circuits to somewhat excessive spark-wear due to large voltage or current, or both, or to the inductance of heating apparatus, small motors, &c. At first sight the switch, of which we give an illustration, appears to be identical with the single tumbler double-pole switch made by the firm, but there are essential differences in construction.



SURFACE FORM OF "QUADBREAK" SWITCH. The switch, as its name implies, has four breaks in its circuit. Its normal limit of voltage is 250, and its effectiveness has been amply proved by tests to show that it will easily deal with more than 50 per cent. increase over its rated current capacity if the circuit be not very inductive. If the nominal current be reduced, the switch may be used on circuits at proportionately increased voltages up to 400. The "Quadbreak" switch is made in 10-ampere and 5-ampere sizes, and a flush pattern is made for 5 amperes only. The construction of the switch shows all that careful attention to detail that has characterised Messrs. Lundberg's accessories.

A RECENT EXAMPLE OF "OSRAM" STRENGTH

FROM time to time we have referred, among their other excellent qualities, to the great strength of Osram drawn wire lamps, as evidenced by the way in which they continually stand up to the many severe tests often experienced in practice. The accompanying illustration, reproduced from an untouched photograph, shows a recent example of "Osram" strength. The photograph was sent by a correspondent, who wrote in his covering letter:—

"Enclosed is a photo which I took in the waiting-room at



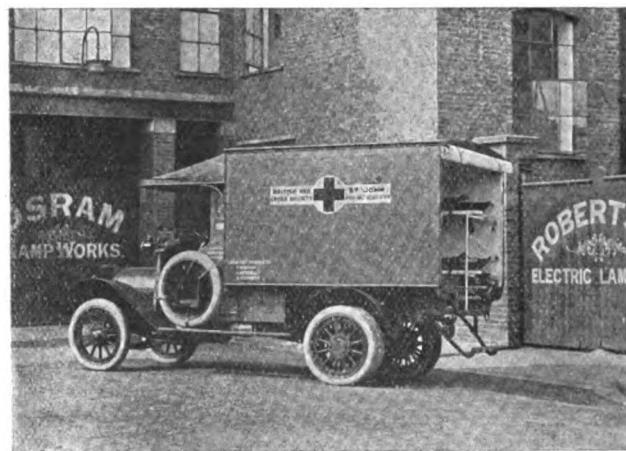
OSRAM LAMP UNBROKEN AFTER FALLING 4 FT.
INTO A HARDWOOD TABLE.

the Mond Nickel Institute, Clydach-on-Tawe. The wire [flex] of the lamp broke, and the lamp and shade fell a distance of 4 ft. on to the wooden table. The shade was smashed to pieces, but the lamp stuck upright in the table, and neither the globe nor the filament was broken; when the photograph was taken it was lighted on another connection."

This incident is but one of many, and serves to show that Osram quality is as good as ever.

OSRAM-ROBERTSON RED CROSS VAN

THE illustration herewith shows the ambulance van presented to the St. John Ambulance Association by the Osram-Robertson Lamp Works. This van is designed to carry eight patients, the driver, and an attendant, and, as will be



noticed, the design of every detail of the equipment conforms to the latest and best practice. The van was photographed outside the Osram-Robertson Lamp Works at Hammersmith, but it is now doing valuable service.

Russian Directory.—The British Engineers' Association has issued a Russian edition of its official directory. The object of the Association originally was to foster trade in China, but an extension of its activities to Russia is opportune, as the openings for trade with that country after the war should be very considerable. The directory contains a guarantee that none of the members of the Association have foreign interests which will be detrimental to Anglo-Russian interests.

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.



Made in
all sizes of
Ordinary & Stout
Substances
to suit varying
Voltages.

BEST QUALITY
INDIA-RUBBER.

Prices on Application.

Manufacturers—

J. G. INGRAM & SON, Hackney Wick, LONDON, N.E.

CORRESPONDENCE

MAGNESITE.

To the Editor of ELECTRICAL ENGINEERING.

SIR.—We are large buyers of magnesite bricks and dead burnt magnesite, which are used for lining electric kilns for steel-making (basic process).

We cannot find sufficient quantity for our requirements; can you kindly, in your experience, suggest a substitute?

Thanking you in advance,

Yours truly,

VERZOCCHI & DE-ROMANO.

Milan, Sept. 29th, 1915.

[Perhaps some of our readers can give the desired information.—ED. E.E.]

CATALOGUES, PAMPHLETS, &c., RECEIVED

METAL FILAMENT LAMPS.—The latest catalogue of Mazda drawn-wire lamps from the British Thomson-Houston Co., Ltd. (77 Upper Thames Street, E.C.), has a cover with a most effective design in blue, yellow, and orange. The list is well arranged, and includes both ordinary and half-watt Mazda lamps. The distribution of light from a standard lamp is shown by a polar curve.

A.C. AND D.C. OVERLOAD RELAYS.—We have received an interesting and instructive pamphlet from the British Thomson-Houston Co., Ltd. (Rugby), which describes overload relays for alternating and continuous-current circuits. The Type S., Form H., for alternating-current operates on excess current, and may be employed for overload or leakage protection. Type S., Form E., is designed for low and medium pressure alternating or continuous-current circuits for connection in series with the line. Time limit devices can be fitted.

"REVO" ELECTRIC FIRES.—The Cable Accessories Co., Ltd. (Britannia Works, Tividale, Tipton, Staffs.), send us a copy of their new list of "Revo" electric fires, which contain a number of distinct and outstanding features. The principle involved in the heating element is that of an incandescent wire coil in free air, provided with a special heat and light reflector of refractory material. It is claimed that the heat emitted is purely radiant. A number of pleasing designs have been registered.

FERRANTI ELECTRIC FIRES.—A folder from Ferranti, Ltd. (Hollinwood, Lancs.), gives particulars and prices of the firm's bar and cone electric fires. The prices of "spares" are also listed.

The Institution.—The opening meeting of next session of the Institution of Electrical Engineers will be held on Thursday, October 28th, when the President-Elect, Mr. C. P. Sparks, will deliver his Inaugural Address. The usual programme for the session has been arranged, and the necessary Papers have been submitted.

It may interest members of the Institution to know that the electric supply from the generating plant at the Savoy Hotel adjoining, which has been taken since the new Institution building was inaugurated, has been abandoned in favour of a supply from the Metropolitan Electric Supply Co.

Electro Harmonic Society.—The first smoking concert of the season will be held at the Holborn Restaurant on Friday, Oct. 8th, at 8 p.m.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aberdeen.—In his annual report Mr. J. A. Bell, the City Electrical Engineer, states there is no question but that additional plant will have to be installed by the autumn of 1916-17, and in view of considerable alterations in the engine-room, which can only be done at one period of the year, and the delays in delivery of the new plant, he will deal with the subject in a special report at an early date.

Australia.—The Sydney Council requires some 33,000-volt three-phase transformers and switchgear, together with spares. Preference will be given to British manufacturers, and a copy of the specification may be seen at 73 Basinghall Street, E.C.

Barking.—The L.G.B. has sanctioned a loan of £13,654 for extensions of plant, mains, &c.

Darwen.—An application is to be made for sanction to a loan of £3,000 for mains and services.

Dublin.—The Corporation has decided to make a number of connections for which applications were made prior to the receipt of the Treasury notice as to restricting capital expenditure. Any further applications are to be submitted to the Treasury for approval.

Littleborough.—H.T. cables, transformers, and switchgear. Consulting Electrical Engineer, W. C. C. Hawayne, 9 Queen Street Place, E.C. Tenders to Clerk. October 22nd.

London: Hammersmith.—The Electricity Department requires a supply of air-cooled static transformers. Borough Electrical Engineer. October 14th. (See advertisement on another page.)

South Africa.—The Pretoria Corporation has decided to raise a loan of £75,000 in connection with electric supply.

Watford.—A loan of £1,560 for mains is to be applied for.

Wiring

Watford.—Lighting and power installation at pumping station. Borough Engineer. October 18th.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Bingley.—Fire brigade station.

Darlington.—Institute in Skinner Street.

Newcastle-on-Tyne.—Rebuilding of N.E.R. No. 3 warehouse at Tyne Dock. Architect, Arthur Pollard, Irving House, Westgate Road.

Miscellaneous

Australia.—The Deputy Postmaster-General, Sydney, requires 100 miles of two-twisted and 75 miles of three-twisted copper wire. Further particulars at 72 Victoria Street, S.W. November 4th.

Birkenhead.—The Mersey Railway Co. requires electrical sundries. General Manager, Central Station. October 14th.

British Columbia.—The High Commissioner for Canada, 19 Victoria Street, S.W., has an inquiry from Victoria for half-watt lamps.

London: L.C.C.—Electric lamps are required for the Council's various asylums. Clerk, Asylums Committee, 6 Waterloo Place, Pall Mall, S.W. October 15th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

The Mirless Watson Co., Ltd., of Glasgow, have received, among others, orders for condensing plants from the following:—The Scottish Central Electric Power Co., the St. Helens Corporation, Société Anonyme Westinghouse, North Lonsdale Iron Co., Rossington Main Colliery, and Greenwood & Batley. Orders for Edwards air pumps from Compagnie Française Thomson-Houston.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £87 10s. to £88 10s. (last week, £87 to £88).

Change of Address.—The Swedish General Electric, Ltd., has now moved into more commodious offices at Canada House, Kingsway, W.C., to which address all inquiries should be sent.

The Late Phoenix Electric Heating Co.—The Dowsing Radiant Heat Co., Ltd., having purchased the useful stock comprising electrical fittings for repair of electric heating and cooking apparatus from the late Phoenix Electric Heating Co., of 17 Morwell Street, W.C., beg to advise the trade that they would be pleased to execute any repairs or supply apparatus previously manufactured by this firm.

Australian Agency.—A Sydney firm wishes to take up agencies of United Kingdom manufacturers of electric lighting sets for motor-cars and electrical fittings, lamps, and sundries. Further particulars at 73 Basinghall Street, E.C.

County of Durham Electrical Power Distribution.—It has been decided not to declare an interim dividend on the preference shares.

Lancashire Dynamo & Motor Co.—An interim dividend at the rate of 6 per cent. per annum is declared on the ordinary shares for the past half year.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. W. L. Phillips, Borough Electrical Engineer at Bedford, has been granted 50 guineas for work done in preparing specifications for and supervising the wiring of the isolation hospital, education committee buildings, &c.

An Overhead Linesman is wanted by the Swindon Electricity Department. (See an advertisement on another page.)

Two Switchboard Attendants are wanted by the Harrogate Electricity Department. (See an advertisement on another page.)

LOCAL NOTES

Bedford: *Relief of Rates.*—Out of the profits made on the electricity works last year, the sum of £2,000 has been transferred to the relief of rates. The gross profit was £13,225, and the balance is represented by interest and capital charges, and £1,610 transferred to reserve fund.

Belfast: *Munition Workers Summoned.*—The local Munitions Court last week fined an electrician 20s. for leaving work at a munitions factory for some hours without authority.

Brighton: *Electricity Deficit.*—In connection with the recent recommendation to increase the charges as mentioned in our last week's issue, Mr. J. Christie, the Borough Electrical Engineer, estimates that coal will cost the Department £8,000 more this year than the already heavy amount paid last year. A heavy loss will also arise through the reduced public lighting. It is calculated that the increased charges which came into operation at the beginning of April will reduce this loss to £5,450, whilst the further increase now recommended will reduce it by a further £4,000.

Cardiff: *Electricity Accounts.*—Satisfaction was expressed at the last meeting of the Corporation with the accounts of the electricity undertaking for the past completed year. The

total income was £3,640 more than in the previous year, whilst the expenditure increased by £1,627. The net result of the year's working was a profit of £5,924, which it is proposed to carry forward.

Colchester: *Electricity Accounts.*—There was a net profit of £813 for the year to March 31st, 1915, compared with £649 in the previous twelve months. Up to Christmas, 1914, it is pointed out that the average price of coal, excluding cartage, was approximately 14s. per ton, whereas at present it is about £1 per ton. Unless, therefore, some unforeseen decrease occurs, there is, it is pointed out, a likelihood of fuel costing about £1,500 more during the current year than last year.

Dublin: *Munition Workers Fined.*—A number of workmen employed by a firm of Dublin electrical engineers engaged on munitions have been fined £1 each for going on strike. The men are still out, and it was stated that warrants for the recovery of the penalty will not be issued for seven days. If within that time the parties come to an agreement, the Chairman of the Court intimated that he would recommend the authorities to remit the penalties.

Fleetwood: *Increased Charges.*—The charges for electric current are to be increased by 10 per cent. The increase, however, will not apply to current consumed through pre-payment meters.

Glasgow: *Inspection of New Electricity Works.*—The members of the Corporation inspected on Friday the preliminary work which has been carried out upon the new Dalmarnock electricity works. Owing to prevailing conditions it is probable that the main work of installing the plant will be considerably delayed, and for the moment all that was available for inspection was the foundations of the turbine-room and boiler-houses and the elaborate arrangement for the intake of water from the Clyde. In this connection six screens have been constructed, each capable of purifying 50,000 gallons of water per minute.

New Electricity Showroom.—The Electricity Department, in conjunction with local wiring contractors, has opened its showroom at 257 Sauchiehall Street. In our issue for March 25th, p. 128, we gave the terms of the arrangement which has been come to between the Department and wiring contractors with the object of avoiding the unfortunate controversy which has existed for so long, and still exists in some parts, between wiring contractors and municipalities who prefer to carry out wiring work independently.

India: *Simla Extensions.*—According to the *Times of India*, the Simla hydro-electric installation has proved so successful that considerable extensions have been decided upon. It is intended to instal a 500-kw. generator with turbine and two 250-kw. transformers with necessary switchgear. The necessary steel piping for dealing with the head of water has already been received, as also have the switchgear and transformers. The turbine is on its way, and the generator is expected by the middle of November.

Newcastle-on-Tyne: *New Tariffs.*—With reference to our Note last week, the Newcastle-on-Tyne Electric Supply Co. and its associated companies have introduced two new tariffs known as the "domestic" and "office" tariffs respectively. Under the first-named the consumer pays a fixed charge on the lighting installation on the basis of 6s. per lampholder per annum. The charge, however, is made on only 75 per cent. of the total lampholders installed, but the tariff is conditional upon the consumer installing electricity for lighting purposes throughout. The fixed charge is payable in full for the first year, and in subsequent years one-third for each winter quarter and one-sixth for each summer quarter only is paid. The charge per unit above this is 1d. without meter rents. The office tariff is an alternative to the flat rate of 1½d. per unit for heating purposes. The consumer pays a fixed charge of 10s. each winter quarter and 5s. each summer quarter, irrespective of the capacity of the lighting or heating installation. The charge per unit in addition is 1d. for heating, lighting being charged at the ordinary standard tariff. All classes of electrical apparatus is hired as it has been done in the past.

South Shields: *Electricity Profits.*—There was a net profit of £3,216 on the working of the electricity undertaking for the year to March 31st, 1915. From this £1,600 are to be contributed to relief of rates and the balance to reserve fund.

Sutton Coldfield: *Loan Refused.*—The L.G.B. has refused to sanction a loan of £2,500 for a new generating set.

Yarmouth: *Increased Charges.*—The Electricity Committee has decided to increase the charge for private lighting from 5d. to 5½d. per unit, and to withdraw the discounts at present allowed in respect of power supply.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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Rates for Small Prepaid and Official Advertisements, see p. vi.

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

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Telegrams: "Cirreling, Fleet, London."

Telephone No.: 5509 Helborn;

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

DETAILED instructions have been issued in Germany as to the electrical accessories and their parts, in which zinc or iron is to be substituted for copper or brass, and the permissible current densities stated. The list includes lampholders, lamp caps, and cable lugs (p. 414).

THE position with regard to the E.C.A. Guaranteed Wiring Scheme is stated (p. 414).

AN appeal is made for recruits for the London Electrical Engineers (Territorial Force) (p. 414).

THE subject of scientific and industrial organisation to meet German commercial competition after the war was dealt with by Professor J. A. Fleming, in a lecture at University College last week (p. 414).

THE large system of the Shropshire, Worcestershire and Staffordshire Electric Power Company has developed to such an extent that the plant capacity had to be increased by 10,625 kw. during the past 12 months. We describe the additions to the plant and the system generally. A feature is the excellent diversity factor, resulting in a load curve practically without a peak (p. 415).

A COMPACT and well-designed $\frac{1}{2}$ kw. petrol-electric set to run without a battery is described on p. 417.

A MULTIPLE lever starting switch is described on p. 418.

MR. A. H. Dykes, in his Presidential Address to the Association of Supervising Electricians outlined a scheme of apprenticeship in the electrical trade (p. 418).

OUR Questions and Answers page describes a convenient workshop method of obtaining a variable frequency for testing purposes (p. 419).

THE opening of the I.E.E. session has been postponed to Nov. 11th (p. 419).

AMONG the subjects of specifications published at the Patent Office last Thursday were electric driven charging pumps for internal combustion engines, train lighting, vapour lamps, and signal lamps. A metal filament patent is opposed (p. 420).

NOTWITHSTANDING street lighting restrictions and other detrimental causes due to the war, the Stepney electricity undertaking made a profit of £10,702 last year. Moreover it has not been found necessary to increase the pre-war tariff (p. 420).

THE difficulties encountered in wireless telegraphy from aeroplanes and airships were discussed by Prof. Fleming, at University College, last week (p. 421).

EXTENSIONS estimated to cost £6,000 are to be undertaken at Wigan; new plant is required at Rotherham, and a telephone switchboard and paper-insulated cable in Australia.—Attention is drawn to the market for electric lighting and power plant in China (p. 421).

IN spite of opposition, the Edinburgh Corporation has decided to proceed with the equipment of the new Portobello power station.—An apprenticeship scheme has been devised in the Marylebone Electricity Department.—There is discontent on the part of some members of the Oldham electricity staff (p. 422).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D.,
COMMANDANT.

Drills, 6.30 to 7.30; 7.30 to 8.30.

(To-day) Thurs., Oct. 14th: Section III., technical. Section I., shooting.

Fri., Oct. 15th: Section IV., technical. Section II., squad, signalling class.

Mon., Oct. 18th: Section I., technical. Section IV., squad.

Tues., Oct. 19th: Section II., technical. Section III., shooting.

Thurs., Oct. 21st: Section III., technical. Section II., shooting.

Fri., Oct. 22nd: Section IV., technical. Section I., squad.

Signalling class Mondays and Fridays, but members will attend technical classes Mondays and Fridays with their Sections.

Recruits attend on Mondays and Fridays.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682), and the Drill Centre is at the H.Q. of the London Electrical Engineers, 46 Regency Street, S.W. (by kind permission of Lt.-Col. A. E. Le Rossignol).

Members will fall in for all drills at the new headquarters, Chester House, Eccleston Place, S.W., on and after Monday, October 18th.

General Sir O'Moore Creagh, V.C., G.C.B., G.C.S.I., has appointed Mr. R. W. T. Corbett and Mr. Hughes-Hallett Platoon Commanders.

Mr. Corbett will take charge of Nos. 3 and 4 Sections and will also superintend the musketry for the Company.

Mr. Hughes-Hallett will take charge of Nos. 1 and 2 Sections and also the signalling.

Mr. J. W. Roger promoted Section Commander No. 4; Mr. H. de P. Birkett promoted Section Commander No. 3; Mr. P. F. Allen promoted Section Commander No. 1; and rank in seniority in above order.

THE GERMAN COPPER FAMINE

THE *Elektrotechnische Zeitschrift* of September 23rd contains some new and very specific instructions, issued by the Verband Deutscher Elektrotechniker, as to the electrical apparatus and parts hitherto made of copper and brass for which iron or zinc are now to be substituted in Germany. In order to save copper, this notice says, it is *absolutely necessary* to use iron or zinc instead of copper in every instance in which it is possible, even at the expense of goodness and life of the article in question.

Makers are warned as to obvious precautions to be taken, for instance, to prevent iron contacts from rusting, by galvanising or lead-covering them, or by "expert greasing," or proper enclosure. Owing to the very diverse properties of the various qualities of zinc obtainable in the trade, it is necessary to be particularly careful in the selection of this metal, and it is also essential to bear in mind its low tensile strength and elasticity, its low melting-point, and also its sensibility to both high and low temperatures. The following articles, it is said, can be made out of iron and zinc:—

Bells. Bearing "brasses." Terminals. Bus Bars and Connections on Switch- and Distribution Boards; these may be of solid iron for D.C. for any current, but for A.C. suitable precautions must be taken. Switches of all classes; from 25 to 100 amperes all parts, with the exception of the spring contacts and the surface taking the actual break, can be of iron or zinc, but this latter exception does not apply in the case of switches with no spark at break, e.g., isolating switches, &c.; connecting bolts and terminals may be of iron.

Plugs and Sockets up to 25 amperes can have all parts made of iron or zinc which have hitherto been made of copper or its alloys, but the actual plugs should preferably be made of iron and not zinc. Over 60 amperes the plugs must be copper or brass, but the other parts can be made of iron or zinc.

Enclosed Fuses: All parts of the fuse-holders hitherto made of copper or brass can be made of iron or zinc with the exception of the screw sockets stamped out of sheet metal for over 60 amperes; all parts of the cartridges hitherto of copper and brass can be replaced by iron or zinc except the connection pieces for the fuse and threaded part which is stamped out of sheet metal for over 60 amperes.

Open Fuses up to 350 amperes need have no copper or brass parts except the spring clips of the fuse-carriers.

Lampholders and Lamp Caps: All parts can be made of iron or zinc instead of copper.

Starters and Regulating Resistances: Up to 100 amperes all copper and brass parts can be replaced with iron or zinc except the end contact which takes the arc; iron or a suitable iron alloy is to be used for the resistances.

Cable Lugs: Up to 35 sq. mm., iron can replace copper or its alloys without change of dimensions; for larger sections iron can also be used, but at lower current rating; special attention must be given to the soldering.

Fixing Screws must be iron, unless a non-magnetic material is necessary on account of eddy current or magnetic conditions.

Tables are also issued of the dimensions of iron and zinc wires, bolts, and bus bars for different currents. Zinc wires are rated at nearly double the section of copper for the same current, and iron wires about $2\frac{1}{2}$ times. Thus a 1.5 sq. mm. copper wire may carry 14 amperes, and a zinc wire of this size 9 amperes. At 2.5 sq. mm. the maximum current is 20 amperes for copper, 11 for zinc, and 8 for iron, and the permissible current densities gradually decrease up to 150 sq. mm., for which the permissible current in copper wires is 325 amperes and in zinc wires 170 amperes. Iron conductors are apparently only contemplated between 2.5 and 16 sq. mm., the latter size to carry 30 amperes. The current densities, therefore, range from about 6,000 to 1,400 amperes per sq. in. for copper, 3,870 to 730 amperes per sq. in. for zinc, and between 2,060 and 1,200 amperes per sq. in. for iron over the range of sizes mentioned.

The E.C.A. Guaranteed Wiring Scheme.—With reference to an article last week referring to the Board of Trade objections to the Electrical Contractors' Association guaranteed wiring scheme, we understand that at a special meeting held at Leicester on Wednesday last week a Committee was appointed to deal with the position.

A Heating, Lighting, and Cooking Exhibition.—The Institute of Hygiene held an exhibition of heating, lighting, and cooking at its building in Devonshire Street, W., from Oct. 4th to 9th. Although on a small scale, the installation was very complete, and showed the application of electricity and other forms of power to various purposes. During the run of the exhibition, a number of lectures were delivered, including one by Mr. L. Gaster on "The Use and Abuse of Lighting."

LONDON ELECTRICAL ENGINEERS (TERRITORIAL FORCE)

Appeal for Recruits

RECRUITS are wanted for the London Electrical Engineers (Territorial Force). This Corps was the first engineering unit formed in the British Army to make use of the services of electrical engineers. It was first started as the Electrical Engineers (Volunteers) in the year 1897 by the late Dr. John Hopkinson, and the name was changed to the present title on the formation of the Territorial Force. Numerous other units utilising the services of electrical engineers have since been formed, but the largest unit is still the London Electrical Engineers.

Owing to the expansion of the Corps, the opportunity now exists for men of suitable age and training to enlist in the unit. Men of the following professions and trades are specially required: Electricians, Mechanical and Electrical Engineers, Engine Drivers, Engine Erectors, Instrument Repairers, Metal Turners, Fitters, Telephonists and Telegraphists. There are a limited number of vacancies for Carpenters, Cabinet Makers, Pattern Makers, Draughtsmen, Joiners, and Wood Turners.

Forms of particulars can be obtained from the Officer Commanding at 46 Regency Street, Westminster, S.W.

The Electrical Engineers (Volunteers) Corps saw active service within three years of its formation, a draft of five officers and forty-seven men taking part in the South African War in 1900, under the command of Lieut.-Col. R. E. Crompton. That was, of course, before the days of high explosives, and many of the uses to which engineering in general, and electrical engineering in particular, are now being put on the various fighting fronts, and which are regarded as commonplace, were distinctly novel during the South African War. The present fighting has been characterised as a telephone war, and it is instructive to note that the plain uninsulated wire now used for telephone purposes for short distances was also used by the Electrical Engineers (Volunteers) South African Detachment, a part of the equipment consisting of bicycles fitted with wire-drums. Indeed, it may be said that the splendid work carried out by the Corps in South Africa furnished the starting-point for many applications of mechanical and electrical engineering to military operations.

SCIENCE ORGANISATION

PROFESSOR J. A. FLEMING, F.R.S., in his lecture at the University College, London, on Wednesday last week, to which reference is made in Telephony and Telegraphy (including Wireless), dealt incidentally with the need for the proper organisation of science and industry immediately, if we are not to be put once more, after the war, under the same domination of German influence commercially as we have been in the past. He complained, however, that although the Royal Society had appointed a number of committees to examine the engineering, mechanical, and chemical aspects, no information had been given to the public as to the constitution of these. He believed the object of this unusual secrecy was to prevent correspondence from eager inventors, but he hardly regarded this as a valid argument, because the names of other committees appointed by the Admiralty and the Ministry of Munitions were known, and no inconvenience had been experienced. The important qualifications of members of committees such as these should not be merely scientific or theoretical, but they should have a sufficient practical knowledge of the matters to be considered. The men who used the things were those who should be able to give the best information. It was impossible to judge an invention by a written description, and although this meant expense, efforts should be made to test on a practical scale schemes put forward, after due consideration of their possibilities. He contrasted the pooling of research work in Germany with the jealousies of British manufacturers, and urged that a disciplined army of scientific workers is badly wanted in this country. By comparison with a military army, our scientific army was a mob of civilians armed for war with shot-guns and sticks. Probably the best solution would be to place the whole scientific organisation of the country from every point of view in the hands of the British Association.

Another question which should be taken up was the use of coal as a means of producing the electrical energy necessary to manufacture atmospheric nitrogen and its compounds. In this connection Professor Bottomley, of King's College, had made a number of enormously important discoveries. For instance, he had discovered that peat treated in a particular way electrically could be made into a fertiliser containing fifty times more value than manure.

A POWER COMPANY WITHOUT A PEAK

THE Shropshire, Worcestershire & Staffordshire Electric Power Co., which is associated with the Birmingham & Midland Tramways Joint Committee, has been developing quietly during the past ten years, and is now one of the most important electric power companies in this country. After the completion of some extensions in the power-house this year, we asked for permission to inspect it, and through

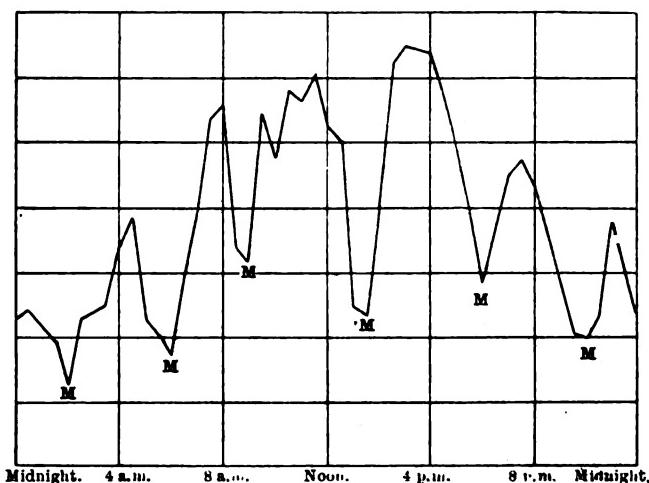


FIG. 1.—TYPICAL LOAD CURVE. M = Meal-times.

the kindness of the Chairman and Mr. J. H. Legge, the Chief Engineer, we are enabled to publish a description of the station and the system generally.

The mains cover an area of about 14×12 miles, and include the districts of Smethwick, Oldbury, and Halesowen (which adjoin Birmingham on the west and south-west), and Dudley; and in addition to the power supply to works, the Company

Fig. 1, which shows that it has no pronounced peak at all. The consumers include about a dozen rolling mills, which in themselves represent nearly half the total load on the station in spite of the large diversity factor which rolling mills always afford; the largest is a mill rolling strip for tubes, and has a 3,000-h.p. motor, taking supply at 5,500 volts, and with a power-factor of 0·78. This is probably the largest motor on any power company's mains in the United Kingdom. Another rolling mill on the Company's mains has a 1,800-h.p. motor. There are several electric welding plants connected to the mains, particularly for welding steel tyres; these range from the heaviest section (one plant for 80 pairs taking 120 kw.) down to cycle-rims. Many chemical works also take power from the Company, and large numbers of general engineering works, including those for the manufacture of lighter articles with automatic machinery, which is, of course, one of the staple industries of the districts near Birmingham. The total connections represent some 22,000 kw., of which about 2,000 kw. is for lighting and 1,500 kw. for tramways; the above lighting total includes Dudley, whose Provisional Order was taken over by the Company from the Dudley Corporation last year, as well as Oldbury, Smethwick, and Halesowen, for which towns the Company also owns Provisional Orders.

The total plant capacity at the Smethwick power-house is just over 17,000 kw., and the supply is at 5,500 volts three-phase 25 cycles per sec. In addition to this, the Dudley power-house taken over from the Corporation has a capacity of 1,600 kw. in D.C. plant, supplying both lighting and tramways, but this station is to be gradually reconstructed and existing reciprocating sets taken out; a 2,000-kw. turbo-alternator set is already being put in, which will run in parallel with the Smethwick plant. Meantime, a 1,100-kw. rotary converter sub-station has been completed at Dudley, in the centre of the town. At Smethwick the plant is made up of the following units:—A 6,250-kw. Brush-Dick-Kerr turbine set, a 4,375-kw. B.T.-H. turbine set, one 2,000-kw. and two 1,000-kw. Brush-Brush turbine set, and three 500-kw. Brush-B.T. H. reciprocating sets (now used only as stand-by). Besides these, there are three 300-kw. and one 100-kw. D.C.

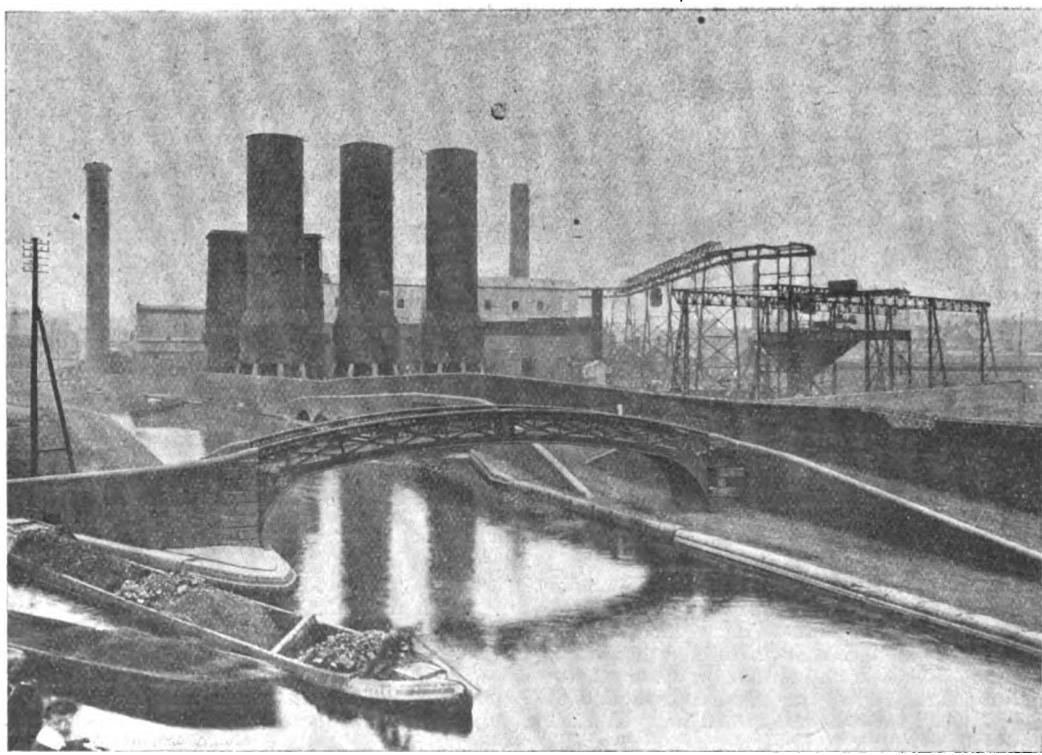


FIG. 2.—GENERAL VIEW OF SMETHWICK POWER HOUSE.

also supplies the tramways managed by the Birmingham & Midland Tramways Joint Committee, viz., the Birmingham District Power & Traction Co., the Dudley, Stourbridge & District Electric Traction Co., the South Staffordshire Tramways, and the Wolverhampton District Electric Tramways. The power supply has developed to such an extent, however, that, in spite of the trams covering a track mileage of 97 and a route mileage of $65\frac{1}{2}$, they represent a comparatively small portion of the load. An idea of the character of the load may be gained from the typical load curve shown in

sets supplying at 500 volts for the tram circuit fed direct from the station, and the station auxiliaries and lighting; two 310-kw. rotaries in the station are also available for this.

It is the 6,250-kw. and the 4,375-kw. sets that have been put in during the past twelve months. The Brush-Dick-Kerr set occupies a floor-space of only about 36 ft. \times 12 ft. with its exciter; its condenser, circulating and air pumps, and a blower for ventilating the generator are in the basement immediately beneath. The turbine is of the pure reaction type. A feature is that the bed is an independent casting:

the cylinder simply rests on bored seats and is held down by its own weight, with a stop to prevent it from rotating. This arrangement is to allow for expansion without undue stresses being set up in the casing. The bearing shell at the exhaust end is prevented from moving axially by means of a strong rib engaging in a groove in the bed-plate seating, while the bearing shell at the other end is free to slide axially. For the high-pressure part of the casing a steel casting is employed, and the remainder is of close-grained cast-iron. About one-quarter of the full output is developed in the high-pressure part, which has four groups of copper blades; the intermediate and low-pressure parts have brass blades and develop a quarter and half the total power respectively. The length of the blades varies from 1 to 10 inches, and lacing strips are silver-soldered to the tips to prevent vibration. To provide for overloads, the first two of the four groups of high-pressure blades are by-passed automatically as soon as full load is reached. The governor is of the centrifugal type, driven through helical gearing from the rotor spindle, and, in addition, there is an emergency governor which closes the stop and emergency valve as soon as the speed is 10 per cent. over normal.

ventilating ducts. The end bells and discs are of manganese-bronze, and the latter are a force fit on the shaft.

The 4,375-kw. B.T.-H. set is of the standard horizontal shaft Curtis pattern, both as regards turbine and alternator. The turbine is five-stage, and the alternator a two-pole machine with a direct-coupled exciter.

So far as the remainder of the engine-room equipment is concerned, the most interesting feature is the switchgear for the new plant, which is of the latest B.T.-H. pattern in stone cubicles with iron doors. The sections of the board are separated by reactances placed in a separate fireproof chamber, and B.T.-H. machine-protective gear is employed and aluminium lightning arresters.

The boilers are of the ordinary Babcock-Wilcox land type with natural draught; bunkers over them can take 2,000 tons of coal, and there is also a big fuel store in the yard. Induced draught plant is being put in for the new boilers. As the station is on the junction of three canals, most of the coal comes in the Company's own canal-boats, but a little is road-borne. A trolley coal and ash conveyor of Messrs. Robert Dempster & Sons' make is employed, capable of dealing with 40 tons an hour. Make-up feed water is obtained from an

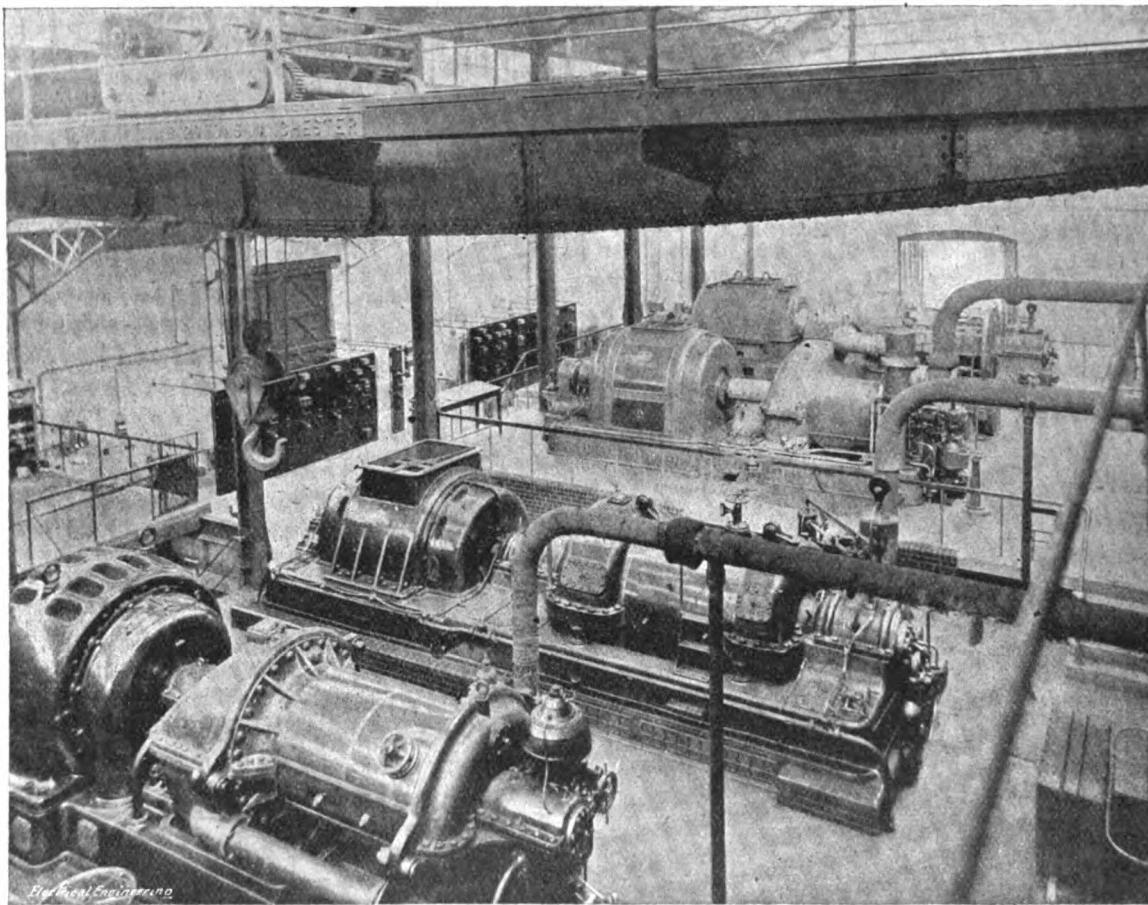


FIG. 3.—ENGINE ROOM OF SMETHWICK POWER HOUSE.

The condenser has 13,250 sq. ft. of heating surface; its tubes are $\frac{1}{4}$ in., and there is 11 ft. 10 in. between tube plates. It is bolted direct to the flange of the turbine exhaust pipe, and expansion is provided for by mounting the condenser on springs.

The speed of the set is 1,500 revs. per min., and the generator is therefore two-polar. It has the usual construction of Messrs. Dick, Kerr & Co.'s turbo-alternators of the cylindrical rotor type. The cast-iron stator frame consists of two shells with a space between them, the outer portion being provided with a chimney-type opening. The end shields are open at the bottom, and air is blown in there and passes through the hollow stator. Pure mica insulation is employed for the copper bar windings of the stator, which are wound in nearly closed slots; in addition, there is an outside protection of leatheroid. The end windings are former-wound, and supported by substantial bronze brackets bolted to the stator end rings. The rotor and shaft are formed of one steel forging. Open longitudinal slots are machined in the body to receive the field windings, which are held in place by manganese-bronze wedges, and there are longitudinal ventilating holes through which the air is blown and discharged through slots placed at intervals to correspond with the stator

artesian well, but part of the make-up circulating water is taken from the canal. For cooling the circulating water there are three Worthington natural draught steel cooling towers, with a collective capacity of 500,000 gallons of water per hour from 100° to 80° F., also a wooden Sylverlast cooling tower of 290,000 gallons per hour capacity. The Worthington towers are estimated together as sufficient to deal with 86,000 lb. of steam for a vacuum of 27½ in. Each has a shell 28 ft. 8 in. diameter, a chimney 22 ft. 8 in. diameter, and a height of 100 ft. The water is discharged by a stand-pipe through a distributor, which revolves by the impulse received and distributes the water over a filling of cylindrical galvanised steel sheets.

So far as the distribution of power over the area is concerned, the system differs from those of the majority of power companies by the load being fairly thickly and evenly distributed, so that it has been found expedient to distribute at 5,500 volts as well as to transmit at this pressure. Ring mains are chiefly used, but in some cases duplicate feeders, and a few of the spares are also in duplicate. For the most part the cables are paper-insulated lead-covered, and drawn into stoneware ducts, but a little is laid on the solid system and there

is a short length of overhead. The biggest E.H.T. cable is 0.25 sq. in. In some parts subsidences have had to be provided against, and the precaution employed has been simply to leave slack in the draw-in boxes. Among the consumers are several rotary converter sub-stations, many of which are running in parallel with existing private generating plants; in some instances the private plants have been gradually displaced in this way. The Company has its own rotary converter sub-stations at Smethwick (600 kw.), Dudley (1,100 kw.), Oldbury (600 kw.), and Tividale (300 kw.), all supplying partly lighting and power and partly traction. At Halesowen the lighting under the Company's Provisional Order is supplied by a static transformer sub-station, with secondary on the four-wire system—lighting 110 volts, and power 190 volts. Although, as has been said, there are many private rotary converter sub-stations, the majority of the works supplied use three-phase current, and have their own sub-stations, while practically all the rolling mills take three-phase supply at 5,500 volts right on to the motors. It would have been interesting to complete this article with descriptions of the plant and methods of electric power distribution at some of these works, but the activity which prevails in all of them at present precludes us from doing so.

THE "UNI-LECTRIC" LIGHTING PLANT

WE have been very favourably impressed with a compact and well-designed petrol-electric set for lighting small houses, &c., recently shown us by Messrs. Walter D. Fair & Co. (43 Leicester Square, W.C.). It is a high-speed set with shunt dynamo and automatic voltage regulation, and as the speed is about 1,950 r.p.m. and the engine a four-stroke machine, this corresponds to about sixteen explosions per sec., so that, as the machine has a heavy flywheel, there

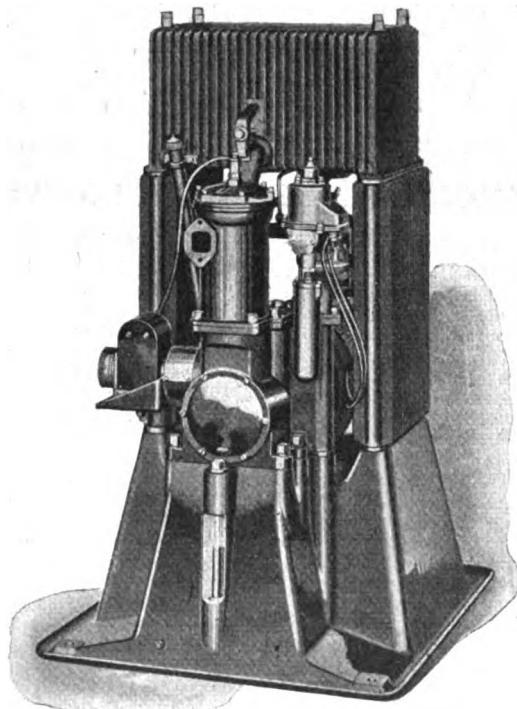


FIG. 1.—"UNI-LECTRIC" GENERATOR SET.

is no perceptible flicker of the lamps, and the set is intended for use without a battery. It is made in one standard size, viz., $\frac{1}{2}$ kw. at 110 volts. Its dimensions are 24 x 22 in. x 39 in. high, and its weight 365 lb.

Figs. 1 and 2 show the general design of the set, and Fig. 3 the generator. This latter, it is seen, is a two-pole machine, and a feature of it is that it is air-cooled by fan-blades on the flywheel; the cooling air is also directed on to the fins on the inner sides of the engine radiator columns. For voltage regulation a simple solenoid and plunger arrangement is provided, acting on the throttle of the engine. The plunger, which is vertical, has a rod attached to it, at the bottom of which is a wooden float in a mercury bath. The upward thrust of the mercury exactly balances the downward pull of the solenoid on the plunger at 110 volts; the solenoid is, of course, simply shunted to the terminals of the generator. At about the centre of the rod is a small rack, which meshes with a pinion and opens or closes the throttle valve according as the rod moves upwards or downwards. Thus it is seen that the voltage is simply regulated by altering the speed of the

engine, which varies from about 1,500 r.p.m. at no load to 1,950 at full load.

Both engine and generator are of American manufacture, the former by the Waterman Motor Co., of Detroit, and the latter by the Wagner Electric Manufacturing Co., of St. Louis.

The base of the engine is a single casting with three compartments. The compartment under the crank-case of the motor forms a reservoir for the lubricating oil, with a capacity sufficient for several weeks' running under ordinary service conditions. A compartment at the opposite end of the base forms with the radiator columns and the tank which

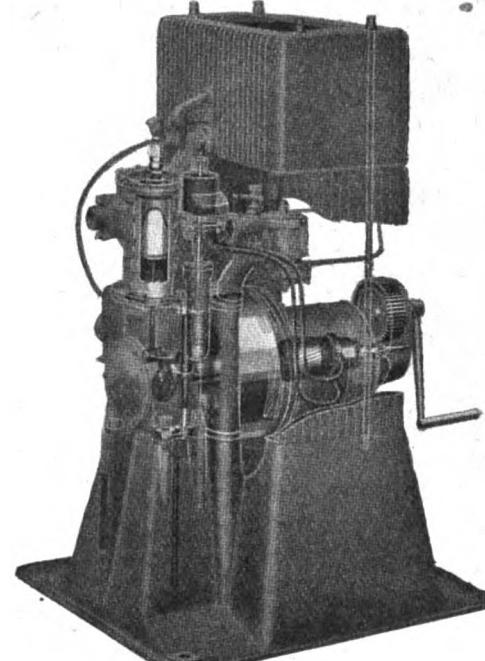


FIG. 2.—"PHANTOM" VIEW OF SET.

surmounts them, a water reservoir with a capacity sufficient for many days at a moderate atmospheric temperature. This water reservoir connects above and below with the water-jacket of the motor cylinder, giving a good thermo-syphon circulation of the cooling water, while the intermediate compartment forms a muffling chamber for the carburettor intake. The fuel tank is mounted below the generator, and connected through an automatic vacuum feeder to a specially designed carburettor. Ignition is by high-tension magneto with fixed spark. Lubrication is provided by an automatic pump in

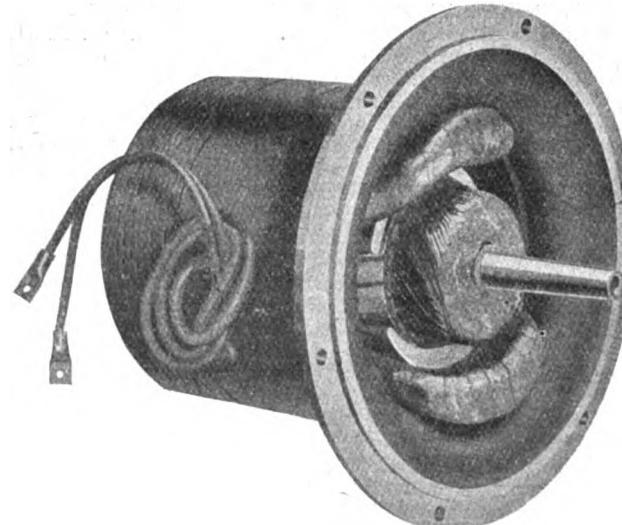


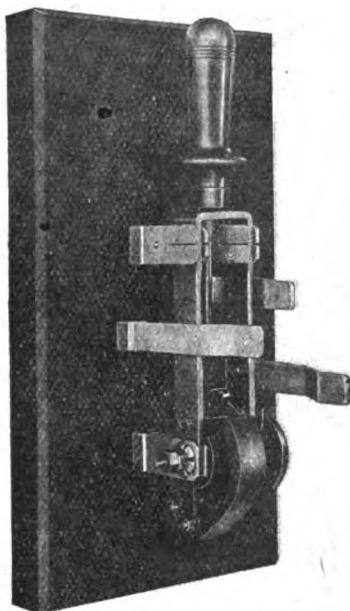
FIG. 3.—THE GENERATOR.

the oil reservoir, delivering the lubricating oil to all friction surfaces. The motor is of the silent sleeve valve type, and the exhaust has a specially large and efficient silencer. All moving parts are enclosed. The engine is started by a simple high-gearied crank, automatic in engagement.

Mr. A. B. Rigby, who showed us the set, informs us that he will be pleased to give further information to any electrical contractors who are interested in it, and has a set on view at the Company's offices at the address mentioned at the commencement of this article.

MULTIPLE CONTACT LEVER STARTING SWITCH

A NEW list issued by the British Thomson-Houston Co., Ltd. (Rugby), describes lever-starting switches of the knife pattern, specially designed for starting large continuous-current motors. They are of the multiple contact double-blade type, and are made in various sizes up to 1,000 amperes capacity.



400 AMP. 4-POINT SWITCH WITH SLOW MOTION DEVICE.
(Closed position.)

The switch can be fitted with a slow motion device, which ensures positive stopping on each contact. When this attachment is fitted, the handle is separated from the switch blade, the latter being actuated through a simple mechanism near the hinge, consisting of a pawl and pin wheel. A guard over the pin wheel lifts the pawl out of action when it passes over more than one pin. Thus each forward motion of the handle drives the pin wheel one step forward. The switch blade thus stops positively on each contact, and, as the motion of the handle has to be reversed in order to engage with the pin wheel for the next step, it is impossible to close the switch without stopping on each contact.

AN ELECTRICAL APPRENTICESHIP SCHEME

A Suggestion by Mr. A. H. Dykes

IN his Presidential Address to the Association of Supervising Electricians on Wednesday of last week, Mr. A. H. Dykes devoted himself to an analysis of our present system of trade education as it affects what may be termed the rank and file of the nation. The matter was discussed at considerable length at the recent meeting of the British Association in Manchester, when a complete session of the Educational Section was devoted to the matter. Then, however, no specific industries were dealt with.

Mr. Dykes, on the other hand, made some definite suggestions with regard to the electrical industry, but before doing so indicated what is being done elsewhere in similar directions. The object behind all this discussion, of course, is to deal with boys either before leaving school or immediately afterwards, and to give them such training as will make them painstaking and industrious craftsmen. It is notorious, of course, that in Germany this problem has been tackled in a far more systematic manner than here, and Mr. Dykes gave complete details of the trade school in Munich which every boy between fourteen and eighteen working in any particular trade must attend. Similarly in this country the Gas Light & Coke Company has instituted a very successful scheme for training their employees in conjunction with the London County Council, the scheme being one combining practical training and general educational class work. As something on the same lines is now suggested for the electrical industry, it may perhaps be remarked that boys are indentured for a term of four years, commencing between the ages of 14 and 16. During the first six months they are engaged in a special workshop, where they learn the use of tools and receive brief lectures from the Company's foremen dealing with the practical part of their work. The next six months they go out in the district with the fitters. This routine is followed in

the second year, during the whole of which time nine or ten hours per week are spent during working hours at the Westminster Technical Institute, where the London County Council have arranged special continuation classes in mechanical drawing, shop arithmetic, &c. After the end of the second year the educational classes are held in the evening, and by a system of weekly, monthly, and terminal reports the Company is kept in close touch with what is going on.

A scheme somewhat on these lines has been worked out by Mr. R. W. Paul for training electrical instrument makers, and, following this up, Mr. Dykes urges employers in the London district to make a commencement by agreeing on a uniform system of apprenticeship. There should be no premium, or, at any rate, only a nominal one. The term should be at least for four years, terminable by the master at any time in the event of laziness, disobedience, or improper behaviour on the part of the apprentice. This, although it might seem unfair, he thinks is necessary to prevent a lad making himself a nuisance in the belief that he could not be discharged. One of the conditions of the indenture should be that the master must allow the necessary time during working hours for the boy to attend the trade school, at least eight hours per week being suggested, during the whole term of the apprenticeship or for not less than the first two years. Mr. Dykes added that he had no reason to believe there would be any difficulty in arranging with the Council and Board of Education a scheme of combined practical and theoretical education, the masters undertaking the practical work, including instruction by foremen and practical men, and the L.C.C. providing special continuation classes at, say, two convenient centres. Both employers and employees would be represented on the Board of Management.

A discussion followed the reading of Mr. Dykes's address, and it is probable that an attempt will be made to give practical effect to this suggestion. The idea seems to be to arrange for the Association of Supervising Electricians and the Electrical Contractors' Association to discuss the matter.

CATALOGUES, PAMPHLETS, &c., RECEIVED

HOLOPHANE INSTALLATIONS.—The illustrated handbook just issued by Holophane, Ltd. (12 Carteret Street, Queen Anne's Gate, Westminster, S.W.), is one of the best got-up booklets of its kind that we have seen for a long time. The object is to show that the Holophane system of illumination is capable of being adapted to any class of building or style of architecture, and there is no better method of doing this than by photographs of actual installations, especially when the photographs show such a degree of technical and artistic merit as in this case. There are separate sections relating to churches, public buildings, railways, private houses, banks and offices, industrial lighting, etc., and in addition to being highly instructive, it will certainly be found very useful for reference purposes by electrical contractors and architects.

ELECTRIC FIRES.—One of the most, and possibly the most, complete lists of electric fires, has reached us from Drake & Gorham, Ltd. (1 Felix Street, Westminster Bridge Road, S.E.). The pamphlet gives prices for, and describes, fires of the Bastian, Belling, Quead, Ferranti, Falco, and Jackson types, and together with the illustrations gives the contractor ample information.

METAL FILAMENT LAMPS.—Pamphlet No. 236 from Drake & Gorham, Ltd. (1 Felix Street, Westminster Bridge Road, S.E.) gives illustrations and prices of all types of metal filament lamps, including half-watt lamps and fittings. A useful feature is the photometric curves, showing light distribution with various forms of Holophane reflectors.

Enemy Shareholders.—At the Bow Street Police Court last week the Phoenix Telephone & Electric Works, Ltd., were ordered to pay fines and costs amounting to £185 10s. for failing to send to the Public Trustee particulars of shares or stocks in the Company held by or for the benefit of enemies. It was stated during the course of the proceedings that the Company had a capital of 8,284 £1 preference shares and 2,757 ordinary £s. shares, and of these, 1,284 preference and 426 ordinary shares were held by four persons residing in Germany. It was not suggested that there had been any deliberate desire to conceal the facts, inasmuch as the return of shareholders made by the Company to Somerset House showed the holding of all the shareholders, but this return, it was held, did not constitute compliance with the Trading with the Enemy Amendment Act.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

QUESTION No. 1,464.

A three-phase supply of about 50 kw., chiefly for power purposes (induction motors), is taken through a static transformer, the primary pressure being 2,000 volts, and the secondary 200 volts. Discuss how many ammeters and voltmeters are absolutely necessary and how many desirable.

(Replies must be received not later than first post, Thursday, October 21st.)

ANSWERS TO No. 1,462.

Please describe an inexpensive workshop method of varying the frequency of 60 periods 50 per cent. either up or down; expensive and elaborate arrangements out of question, as the changes are only required for testing purposes.—"W. E. L."

The first award (10s.) is given to "E. H." for the following reply:—

Undoubtedly the most satisfactory method would be to have an alternator driven by a commutator motor, but the expense would probably be prohibitive. The alternator could be driven by a slip-ring motor designed for the maximum speed, but the value of the resistances to give the necessary speed variation would be very large, especially if the minimum speed is required with a small load.

If "W. E. L." possesses two induction motors, of which one at least must be of slip-ring type, the following method may prove the most convenient.

Connect the 60-cycle supply to the stator windings of the slip-ring motor *A*, and the rotor terminals to the apparatus or machinery to be tested. If the rotor be held stationary, the frequency thus obtained is the same as that supplied to the stator, the motor then acting as a transformer. Next, couple the second motor *B* through a belt and pulley of suitable size to the first machine *A* so that the rotor of the latter is being rotated at a desired speed. Then if R_1 =synchronous speed of *A* in r.p.m., R_2 =speed at which its rotor is being driven by *B*, p =pairs of poles on *A*, and f =supply frequency, we have $f = \frac{R_1 p}{60}$.

Now if the rotor of *A* is being revolved in the opposite direction to that of the field, the relative speed between the rotor and the rotating field is $(R_1 + R_2)$ r.p.m., so that the frequency induced in the rotor is given by

$$f_1 = \frac{(R_1 + R_2)p}{60} = f + \frac{R_2 p}{60}.$$

On the other hand, if the direction of rotation of *A* is the same as that of the magnetic field, the speed at which the rotor cuts the latter is $R_1 - R_2$, and the corresponding frequency is

$$f_1 = \frac{(R_1 - R_2)p}{60} = f - \frac{R_2 p}{60}.$$

By varying the size of either or of both pulleys, any desired value of R_2 , and consequently of the frequency, can be obtained. If the value of the rotor voltage is unsuitable, a transformer can easily be inserted either in the stator or in the rotor circuits.

The second award (5s.) is made to "L. R." for the following reply, which we print in slightly abridged form:—

The simplest method of obtaining the frequency change mentioned is by means of a small induction motor with wound

rotor and means for driving the rotor when necessary. If the frequency in the stator is f_1 cycles per second, that in the rotor will be the same when the motor is standing still, but will be reduced when running in the proportion of the slip, so that

$$f_2 = f_1 \times \frac{n_1 - n_2}{n_1} = f_1 \times s.$$

If we regard the induction motor as a transformer, we shall see that it consists of a set of primary circuits, which are supplied from the mains, and of a set of secondary circuits. Electromotive forces will be set up in both windings; a back E.M.F. in the primary or stator winding; and in the secondary, or rotor winding, another E.M.F., namely, that which drives the rotor current. Let Z_1 be the number of stator conductors in series in any one phase of the stator, and Z_2 be the number of conductors in series in any one phase of the rotor, and let the flux (per pole) that is common to stator and rotor be denoted as N . Then we shall have for the two electromotive forces induced in the primary and secondary the following expressions:—

$$\left. \begin{aligned} E_1 &= kf_1 Z_1 N / 10^8 \\ E_2 &= kf_2 Z_2 N / 10^8 \end{aligned} \right\}$$

Here k is the Kapp coefficient of value about 2·14. Assuming that k is practically the same for both windings, we have

$$\frac{E_2}{E_1} = \frac{f_2 Z_2}{f_1 Z_1};$$

or, inserting the value of f_2 ,

$$\frac{E_2}{E_1} = \frac{n_1 - n_2}{n_1} \cdot \frac{Z_2}{Z_1} = s \frac{Z_2}{Z_1}.$$

As the slip is the ratio of secondary frequency to primary frequency, if the natural slip be altered in any way, for instance, by mechanically driving the rotor, the desired frequency is obtained at the rotor terminals, and the electro-motive force is substantially given by the above equation. (In practice other considerations arise to vary this, and for a full analysis of the matter reference should be made to "Alternating-current Phenomena," by Steinmetz, pp. 262 to 279.)

This kind of frequency-changer is commonly used for changing from about 25 periods up to about 60, the rotor being mechanically driven backwards against the torque. Mostly a synchronous motor is employed connected to the primary mains, which by over-excitation compensates also for the lagging current of the frequency converter.

Another machine has been provided by Brown, Boveri & Co., and comprises an alternating-current commutator generator self-excited, each field magnet pole having two windings excited by voltages displaced by 90° in phase. By regulating the current flowing through one of the field windings the voltage only is altered, and by regulating in the circuit of the second winding only the frequency is changed. This also is a simple machine with great control. It is fully described in Patent No. 7,061 of 1911.

The Electric Vehicle Committee.—A meeting of this Committee was held in London under the chairmanship of Mr. R. A. Chattock on October 1st. Mr. V. Mason took his seat on the Committee as the representative of the Tramways & Light Railways Association. The Committee had submitted for their inspection, by the Krieger Electric Carriage Syndicate, Ltd., the first of the new "Ward" light delivery vans to arrive in this country from America. As to further publicity work, it was decided that no more could be done at the present time than to concentrate upon keeping going successfully the official organ, *The Electric Vehicle*. The further standardisation of details in connection with lead plate batteries was discussed, and the Committee will now await the decision of the Accumulator Makers' Section of the B.E.A.M.A. upon their proposals.

The Institution.—The following are the arrangements for the first half of the forthcoming session:—November 11th, Presidential Address by C. P. Sparks; November 25th, "Difficulties of Design of High-speed Generators," by Prof. A. B. Field; December 9th, "The Design of High-pressure Distribution Systems," by J. R. Beard; January 13th, "The Predetermination of the Performance of Dynamo Electric Machines," by Prof. Miles Walker; January 27th, "The Possibilities in the Design of D.C. Traction Motors, &c.," by N. W. Storer.

The Council have elected Mr. J. E. Kingsbury to be Honorary Treasurer of the Institution in place of the late Mr. Robert Hammond.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 7th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

19,492/14. Electric Driving of Charging Pump of Internal-combustion Engine. A.E.G. The charging pump is driven by an electric motor started from a special source of power, such as an accumulator, but normally run from a dynamo driven by the engine. (Five figures.)

19,977/14. Train Lighting. C. H. VIDAL. A system in which the dynamo is excited by a current caused by the difference of pressure between the battery and the generator. The two halves of the battery are connected in series as regards the load circuit, and the generator is provided with two armatures and commutators in a common field. The armatures are connected across the respective halves of the battery, one being wound to give approximately the normal pressure of half the battery and somewhat higher pressure for charging one of the halves of the battery at a time. (One figure.)

24,766/14. Vapour Lamp. H. J. S. SAND. An improved "solid metal" vapour arc lamp using the vapour of a metal such as cadmium, in which the adherence of the metal to the glass on cooling is minimised by the presence in the lamp of a loose fine powder, such as zirconia. (Two figures.)

3,002/15. Signal Lamp. A. H. MIDGLEY and C. A. VANDERVELL. A light hand-signalling lamp for use on aircraft, with a handle like that of a revolver with the trigger arranged to work the shutter. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Heating and Cooking: COLLINS and COLLINS [Heating elements] 20,728/14; SMITH [Electric heating of steering wheels] 24,049/14.

Instruments and Meters: FAWSSETT [Induction instruments] 7,270/15.

Storage Batteries: JOEL [Accumulator charging] 23,189/14.

Switchgear, Fuses and Fittings: LUNDBERG, LUNDBERG, LUNDBERG and PEGG [Switches] 367/15; R. BOSCH [Band resistance for use with pedal switches] 11,480/15.

STEPNEY ELECTRICITY ACCOUNTS

THE annual report dealing with the Electrical Department of the Stepney Borough Council for the year to March 31st, 1915, is interesting first of all because of the large net profit, namely £10,702, and secondly because although many London and provincial electrical and gas undertakings have found it necessary to advance their charges for power and lighting, it has not been found necessary at Stepney to depart from the pre-war tariff. The satisfactory financial result is in a large measure due to the peculiarly industrial character of the borough attracting a considerable number of Government contracts, for which a large amount of electric power is required. The number of units generated and sold were respectively considerably more than double the corresponding figures of four years ago, the number of units sold being 18,757,007, an increase of 2½ millions over the previous twelve months. The power units, 7½ millions, were slightly over 1½ millions up. In addition to this, private bulk supplies account for slightly over four million units, an increase of nearly half a million units.

It was in the East End of London that linking up between the electrical undertakings was first taken seriously in hand, and it is satisfactory to note that the arrangements under the agreement with the Poplar Borough Council for reciprocal supplies still continues to be a great convenience. At the end of December bulk supply to the Shoreditch Borough

Telephony and Telegraphy: SHEPARD & McKECHNIE [Submarine signalling] 21,680/14.

Traction: Soc. ANON. DES ETAB. L. BLERIOT [Car lighting] 16,935 & 16,936/14.

Miscellaneous: MARSHALL [Relighting miners' lamps] 13,443/14; BLACK [Signalling in mines] 17,000/14; LOCHHEAD [Signalling in Mines] 19,388/14; BRUCK [Magnetic separators] 20,551/14; THORDARSOX [Coil winding machine] 21,881/14; TAYLOR [Transformation of energy by condensers] 22,674/14; Macdonald [Electric bells or gongs] 23,211/14; GARDNER [Vibratory contact makers] 24,475/14; HATTON [Electric clocks] 24,637/14; O'DONNELL (Hodges and Smith) [Electric alarm for mines] 1,119/15; MELLERSH-JACKSON (Posen) [Pocket flash lamps] 2,934/15; Wood [Conductors] 9,336/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Ignition: Soc. ANON DES ETAB. L. BLERIOT [Dynamo-magnetic ignition] 11,566/15.

Incandescent Lamps: MACKAY [Lamps] 12,994/15; ORANGE [Lamps] 12,995/15.

Opposition to Grant of Patents

Opposition has been entered to the grant of patents on the following specification:—

29,980/13. Metal Filaments: WOLFRAM LAMPEN A.-G. Alloys of tungsten and another metal with a small proportion of a third metal which acts as a catalyst to facilitate sintering.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS AND TRANSFORMERS: LANCASTER DYNAMO & MOTOR CO. and R. S. MCLEOD [Reversible boosters] 14,373/02; SIEMENS SCHUCKERTWERKE [Variable frequency alternator] 9,048/09.

Electrochemistry and Electrometallurgy: O. IMBAY (Soc. Anon. d'Etudes Electrochimique, Geneva) [Arc furnace for promoting gaseous reactions] 13,952/04; L. PATTHOFF [Electro-deposition of metals on steel] 14,058/04 and [Electro-galvanising] 14,059/04; LANGHEIN-PFANHAUSER WERKE A.G. [Electro-deposition] 14,091/09.

Heating and Cooking: A. F. BERRY [Heating by induced currents] 13,107/09.

Telephony and Telegraphy: W. P. THOMPSON (Ges für drahtlose Telegraphie) [Wireless circuit tester] 14,451/07.

Traction: H. LEITNER [Train-lighting dynamos] 12,645/05.

Council was inaugurated, and will be continued until September, 1916. During the past year the full supply contemplated when the agreement was entered into early in 1914 could not be given or taken in view of the unavoidable delay in the installation of machinery for both undertakings.

The total cost per unit sold was 1'024d. against 1'022d. per unit in the previous twelve months, and, in reviewing this, cognisance must be taken of the increased cost of coal and the abnormal conditions prevailing generally. At the same time the full effect of the high price of coal is not apparent in the accounts under review, and must more seriously affect the results for the current year. The undertaking has also suffered through the inability to obtain plant which was on order, which would have resulted in considerable economies in the cost of production.

Owing to the restrictions placed upon capital expenditure by the Treasury, the further hiring out of motors has been discontinued, and they are now being supplied under short-period hire-purchase terms. This policy has been adopted elsewhere irrespective of the ban on capital expenditure, and it has been found that electric motors can now be relied upon to such an extent that users prefer to purchase them in this way.

In dealing with the balance available, it has been decided to allocate £6,165 towards expenditure of a capital nature, to add £2,000 to reserve, and, after meeting various other smaller sums, to carry forward a balance of £1,134.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

In a lecture at the University College, London, on Wednesday last week on science during the war and after the war, Professor J. A. Fleming gave some interesting particulars with regard to the use of wireless telegraphy on aeroplanes and airships. The difficulties with aeroplanes, he explained, are considerable in consequence of the weight of the apparatus. A military aeroplane when loaded to its fullest extent has in addition to the pilot an observer, a certain quantity of bomb ammunition, and a gun equipment. Hence the necessity for the wireless apparatus to be as compact and light as possible. It is laid down as essential that the weight of the apparatus must be kept below 100lb., and equipments have been designed weighing only 30lb. The French use a 70lb. set. Another difficulty is the disposal of the aerial wire. Sometimes it is made of aluminium, and is stretched across the planes on insulators, but there are objections to that arrangement. Another way is to let the wire trail out behind the machine when in use, winding it up when not wanted. Many airmen, however, object to this method, owing to the risk of the wire catching in the propeller or trees. Messages can be sent from aeroplanes a distance of about 30 miles, and, for the most part, the receiving stations are the well-known Marconi portable pack sets. The noise of the engine and the rush of air, said Professor Fleming, renders the reception of messages very difficult, especially as they are sent in secret code, and every letter must be heard distinctly. Efforts, however, have been made to devise methods of reception which appeal to the eye instead of to the air, but the exceedingly small currents set up in the aerial wire by the received current has rendered the problem so difficult that it has not yet been completely solved. Another difficulty to be got over in wireless from aeroplanes is the efforts made by the enemy at jamming. With airships, Professor Fleming continued, there are other difficulties. Airships of the Zeppelin type are usually constructed with a framework of aluminium containing eighteen or twenty balloons inflated with hydrogen. The earth being at negative potential compared with points above it, the balloon takes the potential of the air where it happens to be, and there is great difficulty in avoiding sparks between the metal boxes in which the wireless apparatus is contained and the framework of the balloon. Sparks 1 in. long have been seen to pass in this way, and it is well known, said Prof. Fleming, that there is a strong possibility that Zeppelin Z4 was destroyed in this way through a spark given off when the ship was near the earth, the spark igniting the hydrogen. The Germans were perfectly well aware of these things, and, concluded the lecturer, there is room for much more experimental work in this connection. It could by no means be said that the practical problems of wireless telegraphy from airships and aeroplanes had been entirely solved.

ELECTRIC TRACTION NOTES

The only private Bill legislation left over for the autumn session of Parliament was the L.C.C. Tramways Bill. When this came before a Committee of the House of Lords last week, Mr. Vesey Knox, K.C., who led for the L.C.C., explained that there only now remained for consideration tramway proposals in Hackney and Bermondsey. The Home Office opposed the first scheme absolutely unless certain street widenings were carried out, which would cost £150,000—an obviously impossible suggestion at the present time, at any rate. The Bermondsey line is at present a horse tramway which it is proposed to convert to electric traction, and here again the Home Office suggested that the scheme should be suspended until arrangements had been made to secure a double track with a space of 9 ft. 6 in. between the edge of the pavement and the outside tramway rail. Evidence was given on behalf of the police authorities, who seem to gain in strength in their objection to tramways as years go by. Stress was laid upon the difficulty of regulating traffic at busy junctions owing to the tramways, but the Committee finally decided that the Bill should proceed.

We understand that considerable progress is being made

with the trolley omnibus scheme between North Ormesby, South Bank, and Normanby. The work is being carried out by a company which obtained Parliamentary powers a year or two ago, and would have been completed ere this but for the war.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Barking.—The Local Government Board has sanctioned loans amounting to £13,654 for the purpose of the electricity undertaking.

China.—In his report on the trade of Shanghai for 1914, Consul-General Sir Everard Fraser comments upon the importance of the market for electric lighting and power machinery in China, and points out that the business has been largely in the hands of German firms mainly because they were willing to undertake entire contracts and to finance them. Nevertheless, British installations have been completed in a number of important cities, and clearly it is a market which British engineers would do well to foster. The British Engineers' Association has already done good work in this connection.

Darlington.—One 3,000-kw. turbo-alternator, with surface condensing plant. Borough Electrical Engineer. Oct. 22nd.

Derby.—Application is to be made for a loan of £3,000 for mains and meters required for firms working on war contracts.

Rotherham.—The Engineer has reported upon the urgent need for further plant in the power station at an estimated cost of £20,000. As this is required to meet demands from firms engaged on war contracts, the Ministry of Munitions has been asked what assistance can be given in the event of the Corporation deciding to put down this extra plant.

Wigan.—A Local Government Board inquiry was held last week concerning a loan of £6,700 for electrical extensions. It was explained that to a large extent this expenditure is necessary by demands due to the war, and, owing to the small margin of plant now available, the supply to the trams had to be curtailed on one occasion when a mechanical stoker broke down. The urgency of the necessity for new plant was impressed upon the Inspector.

Wiring

Dublin.—Lighting of public baths and washhouses, Tara Street. Chairman, Public Health Committee. October 25th.

Dundee.—Lighting of Shipyard Y at the New Wharf, Gourlay's Old Shipbuilding Yard. J. H. Thompson, Engineer, Harbour Trust. Oct. 21st.

Gomersal.—Electric lighting of weaving shed for Gomersal Mills. Architect, C. D. Swale, 5 Cabinet Chambers, Leeds.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Altrincham.—School.

Darwen.—Extensions to Mossbridge Hospital.

Miscellaneous

Australia.—The Deputy Postmaster-General at Sydney requires 59 miles of paper-insulated lead-covered cable. Tenders by November 4th. This information, of course, is only of value to firms who can instruct agents by cable.

The Sydney Harbour Trust Commissioners require three electrically-operated railway freight-car transmitters. Tenders to the Commissioners, Circular Quay, Sydney, by January 31st. A copy of the specification can be inspected at 73 Basinghall Street, E.C.

The Deputy Postmaster-General, Melbourne, requires eleven sections of a lamp-signalling trunk-line switchboard for the Melbourne Trunk Exchange.

Cuba.—The Havana Electric Railway, Light & Power Co. has been authorised to construct a new double-track tramway.

London Lighting.—We commented in our last issue upon the new regulations regarding the lighting of private premises, shops, and railway trains in London. These, apparently, have been so effectively complied with that it has now been found that the reduced street lighting, which has been in force for some time, is insufficient to secure reasonable safety for the public in the streets. Consequently the Commissioner of Police, on the advice of the Anti-aircraft Department of the Admiralty, is considering to what extent public lighting shall be increased.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Edinburgh.—The Corporation has adopted a recommendation by the Electricity Committee to accept tenders for turbines and alternators for the new Portobello power station. Messrs. Fraser & Chalmers are the successful tenderers at £23,251, with Messrs. Vickers as sub-contractors for the alternators. The contract for condensing plant also goes to Messrs. Fraser & Chalmers at £7,611, with Messrs. Richardsons, Westgarth & Co. as sub-contractors. Delivery under above contracts is to be made in the summer of 1917. There was some opposition to the expenditure of so much money at the present time, but the recommendation was approved by 35 votes to 11, it being explained that the demand for current is extending at such a rate that the department would be in a very serious position if it did not look well ahead.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. P. Wilson, A.B., Anti-Aircraft Corps, has been granted a temporary Sub-Lieutenancy in the Royal Naval Volunteer Reserve.

A Charge Engineer is wanted in the Bermondsey Electricity Department. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £87 10s. to £88 10s. (last week the same).

Competition with Germany and Austria-Hungary.—In connection with the campaign undertaken by the Board of Trade to assist British manufacturers and merchants to secure the trade formerly in the hands of German or Austro-Hungarian firms, the Board continues to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these inquiries, and British firms interested as suppliers in any of the goods mentioned in the weekly list of articles (No. 41), which may be obtained on application, are asked to communicate with the Director of the Branch, 73 Basinghall Street, E.C.

Trade with China.—Mr. T. M. Ainscough, the Special Commissioner appointed by the Board of Trade to inquire into the conditions and prospects of British trade in China, has now returned to this country, and is prepared to interview (by appointment) representatives of British firms, who may be able to see him at the offices of the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

Agency.—The Board of Trade Journal states that an agent in Rome is prepared to buy or sell on commission electrical machinery of British manufacture.

Greenock Electrical Society.—This Society holds its first meeting of the new session to-morrow, Friday, when the Honorary President, Mr. Frank H. Whysall, Chief Electrical Engineer, Greenock, will give a lecture on "The Construction of Storage Batteries." Mr. W. B. Smith, Chief Assistant Electrical Engineer, Greenock, is the President.

LOCAL NOTES

Cheltenham: Electricity Department Progress.—There is general satisfaction with regard to the result of the working of the Electricity Department for the past year. There was an actual increase of £646 in revenue, and the very large increase in the output for power, namely, 55,000 units, is an indication that the 1d. per unit charge is a wise policy. The general figures for the past year are held as an indication that Cheltenham has resumed its normal condition in spite of the war.

Derby: Accident to Steam Turbine.—The Corporation have decided to take £800 from the reserve fund for repairs to a steam turbine at the Electricity Works. It was explained at the last meeting that the engineer-in-charge had been guilty of an error of judgment which had resulted in the destruction of a large part of the plant. The Committee were of the opinion that the engineer-in-charge was to blame, and they had requested him to resign.

Dover: Electricity Department Estimates.—The Electricity Committee, reporting upon the prospects for the current twelve months, anticipates a loss of £555, as against a net profit of £2,525 on the past completed year. This loss is accounted for in the greater cost of fuel and loss of the street lighting.

Keighley: Electricity Profits.—In his annual report the Borough Electrical Engineer points out that the year to March 31st, 1915, by reason of the engineers' strike and the war, had been one of the most trying possible for the Electricity Department. Generally speaking, the position remains the same as it was at the end of the previous twelve months, but there are signs of the development of a reasonably large night load. There was a net profit of £1,024 for the year compared with an estimated profit of £3,409.

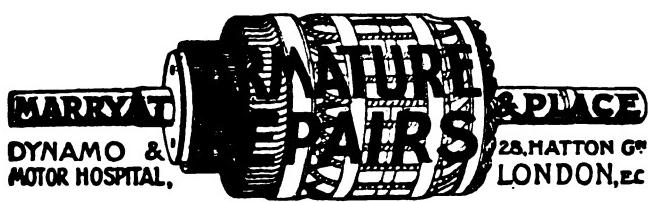
London: Marylebone: Increased Charges.—The Electricity Committee, in asking for a further increase of 10 per cent. to be made on consumers' accounts, points out that the increased price of coal, expenses incurred in guarding the Electricity Works, and allowances to employees on active service, alone amount to £9,787.

Apprenticeship Scheme.—The Electricity Committee has prepared a scheme by which a limited number of apprentices will be admitted to the department, and after a period of probation will be indentured. It is hoped by this scheme to minimise such troubles as were recently experienced in connection with the "running staff." Only youths over fifteen who have shown special qualifications or talent for engineering work, and who have received a good technical education, will be considered, and during apprenticeship every possible facility will be afforded. The remuneration will begin at 5s. per week for the first year, and gradually rise to 20s. per week, whilst all who show special diligence and ability will be given opportunities for filling vacancies on the permanent staff. This scheme is interesting in view of the presidential address by Mr. A. H. Dykes to the Association of Supervising Engineers, reported on page 418 of this issue.

London County Council: Greenwich Switchgear.—In October, 1913, the L.C.C. accepted the tender of the British Westinghouse Co., amounting to £17,915, for high-tension switchgear for Greenwich. Most of the work has been completed, but the Council is unable to accept delivery of the remainder until the second of the new turbo-generators has been erected. Under the terms of the contract the certificate for the work already done cannot be issued until the whole of the work has been completed, but the Highways Committee, in view of the circumstances, recommend that a further payment on account amounting to £4,885 should be made to the Company. This sum, together with the payments already made, represents 90 per cent. of the value of the completed work and 50 per cent. of the value of materials delivered.

Oldham: Electricity Staff Discontent.—A certain number of employees of the Oldham Electricity Department, who are members of the Municipal Employees' Association, recently made a claim for a war bonus of 2s. per week for their members earning over 30s. weekly. The demand was resisted, and notices to leave work have been sent in. At the moment these have not been acted upon, probably because the Town Clerk has informed the men that in his opinion they come under the operation of the Munitions Act. The men, on the other hand, deny this, and it is possible that the whole matter will go to Board of Trade arbitration.

Diesel Engine Users' Association.—The next meeting will be held on Wednesday, October 20th, at the Institution of Electrical Engineers, when the subject of lubrication of Diesel engines is to be further discussed.



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THE ELECTRICAL ENGINEER
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Chques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

AN outline is given of the new British standardisation rules for electrical machinery shortly to be issued by the Engineering Standards Committee (p. 424).

A BRABANT paper has published a short description of the barricade of live electric wires erected by the Germans on the Belgian-Dutch frontier (p. 424).

WE give a description of new plant installed at the Limehouse generating station of the Stepney Borough Council, comprising two 5,000 kw. turbo-generators, with boilers, switchboards, and other auxiliary machinery. The new installation was officially inaugurated by the Mayor of the Borough last week (p. 425).

WE discuss one or two matters relating to increased electricity charges (p. 426).

OUR Questions and Answers columns deal with the calculation of starting and controlling resistances for a large induction motor (p. 427).

AMONG the subjects of specifications published at the Patent Office on Thursday last were compensation of motors for temperature, heating elements, and accumulator charging. A lapsed patent for metal filament mounting has been restored (p. 429).

THE difficulty in obtaining steel tyres is being considered by a Special Committee.—The liability of electric railways to damage by hostile aircraft has been discussed in Switzerland (p. 429).

A NEW catalogue of artistic electric light fittings is reviewed, and a description given of a new electric vehicle (p. 430).

A SHORT review of the October B.E.A.M.A. Journal appears on p. 431.

A 4,000-k.v.a. turbo-alternator, &c., is required at

Cape Town; generating plant at Chesterfield; two Diesel engines at Bo'ness; Diesel engine at Pembroke; and extensions are contemplated at Wolverhampton (£5,000) (p. 431).

THE Manchester Ratepayers' Association still continues its opposition to the Barton power station scheme.—Objection has been taken to the paying of the full salary to the Barnsley Borough Electrical Engineer, who has enlisted.—Rapid progress was made last year in the Barrow Electricity Department, the number of units increasing by no less than 72 per cent. (p. 432).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDANT.

Drills, 6.15 to 7.15; 7.15 to 8.15.

(To-day) Thurs., Oct. 21st: Section III., technical. Section II., shooting.

Fri., Oct. 22nd: Section IV., technical. Section I., squad.

Mon., Oct. 25th: Section I., technical. Section III., squad or working party.

Tues., Oct. 26th: Section II., technical. Section IV., shooting.

Thurs., Oct. 28th: Section III., technical. Section I., shooting.

Fri., Oct. 29th: Section IV., technical. Section II., squad or working party.

The Headquarters are at Marconi House, Strand, W.C. (Tel: City 682).

Sections for technical drill will fall in at the Headquarters of London Electrical Engineers (T.F.) at 46 Regency Street, S.W. Sections for squad, signalling, and working parties will fall in at the new Headquarters, Chester House, Eccleston Place, S.W.

All members who have not yet been measured for uniforms will attend at Headquarters on Friday, the 29th inst., for this purpose.

Fatal Electric Shock.—An inquest was held on Wednesday last week into the death of T. E. Green, who received a fatal electric shock in the South London Electric Supply Corporation's electricity works at Loughborough Junction. It appeared from the evidence that the deceased received a 3,000-volt shock whilst testing the insulators in one of the cells in the switchboard. No one was present at the time, but the unfortunate man was found leaning across the live conductors with his clothes on fire, his feet being on the top of a pair of steps. The evidence went to show that during a few moments' consciousness at the hospital the deceased stated that he had slipped. It was also stated that the regulation that all cells must be made "dead" before being interfered with was not complied with.

Institution of Electrical Engineers: Western Section.—The first meeting of the session will be held in the Bristol University on Monday next, October 25th, at 5.30 p.m., when Mr. D. E. Roberts, the chairman, will deliver his address.

Institution, Birmingham Section.—The 1915-16 session of the Birmingham Local Section of the Institution of Electrical Engineers opens on Wednesday next, October 27th, at the University, at 7 p.m., when Col. J. F. Lister, the Chairman, will deliver his address.

NEW BRITISH STANDARDISATION RULES FOR ELECTRICAL MACHINERY

In a Paper on the "International Standardisation of Electrical Machinery," read before the Institution of Electrical Engineers in December, 1913, Mr. A. R. Everest discussed the necessity for establishing standards for the design of electrical machinery, and indicated the work which had been done in this direction by the International Electrotechnical Commission. This body had studied the subject through its various National Committees; it had collected information and discussed the subject at its various meetings; and, finally, it had established the necessary data in such a form that it was available for practical purposes, with the result that various countries had taken up the task of remodelling their national standardisation rules in accordance with the standards developed by the I.E.C.

In this country the Engineering Standards Committee has been engaged upon this task, and is now arranging for the publication of new "British Standardisation Rules for Electrical Machines and Transformers." An outline of these rules is indicated by Mr. Everest in an article in the current issue of the *B.E.A.M.A. Journal*.

The most important feature of novelty appears to be the adoption of the "continuous maximum" basis for rating. The practice in this country has hitherto been to rate a machine at a certain load and to specify a daily permissible overload for a limited time. It is now proposed to abolish these overload allowances and to fix the rated load at that load which the machine will stand continuously without time limit and without exceeding the specified temperatures. In other words, the nominal full load of a particular machine will be 15 to 20 per cent. higher than it would be according to the old rules. Thus a machine which was called, say, a 100-h.p. motor capable of 25 per cent. overload for a certain time will in future be called a 115-h.p. or a 120-h.p. motor, according to the load it is capable of taking for an unlimited time, and no overload will be specified. This is at least a more rational procedure, and it will have the advantage of making a British machine directly comparable as regards rating with a foreign machine. Of course, a machine may be capable of overload; it may develop sufficient torque, or have sufficiently good commutation, and be mechanically strong enough, to take a large overload, and the necessity for this will be recognised; but the point is that overload can only be applied when the machine is below its ordinary "full load" temperature. When the machine reaches this temperature no overload is permissible, except, of course, momentarily.

A change in the nominal full load of a machine will naturally make changes in its nominal performance in other respects. For instance, consider an induction motor rated at 100 h.p. capable of developing a torque corresponding to 200 h.p. If its nominal full load is in future to be 120 h.p., its maximum torque will be 66 per cent. in excess of full load instead of 100 per cent. as before, though actually, of course, it has not changed. Similarly the new "full load efficiency" will not in general be the same as before, but will be the efficiency, in this particular case, at 120 h.p. instead of at 100 h.p. The point of maximum efficiency also may be changed; if it was formerly 90 per cent. of full load, it will in future be 75 per cent. in our chosen example.

For the special cases of continuous variable load with recurring high peaks there is provided a special "duty cycle rating," a machine for such duty being rated for test and comparison purposes at a value of continuous steady load which would produce the same temperature rise as the special load with known recurring peaks.

For intermittent service the "short-time" rating already familiar in the case of crane and hoist motors is retained. Traction motors are not covered under the forthcoming issue of the new Rules, being reserved for special treatment.

With regard to temperature rise, it has been the practice to allow a rise of 15° C. in association with the overload of about 25 per cent. The nominal full load is now increased to cover this 15°, but as there is to be no time limit, the increase in rating will be something less than 25 per cent.

The limits of temperature rise are specified for different insulating materials, and are dependent on two factors: the highest temperature which may be reached by the insulating materials, and that which may be reached by the cooling air.

The tables of permissible temperatures and temperature rises given in the new Rules are expressed in terms of "observable" temperatures, i.e., temperatures as measured by thermometer or by the method of resistance. An indica-

tion is given of the particular method which should be employed for measuring the temperature of each part of a machine.

The maximum temperature to which the cooling air may rise is fixed at about 40° C. as an average figure, which, however, may vary slightly under abnormal conditions of location, weather, &c. For high-voltage machines, lower temperatures rises are permitted on account of the greater internal temperature differences due to thicker insulation. Special provision has been made for the case of large turbo-alternators where methods of temperature exploration may be employed which would not be commercially feasible in smaller machines.

The high-pressure tests differ little from existing good practice.

After allowing for the differences introduced by the adoption of the old "overload" condition as approximately the new British "rated load," it will be seen that the values assigned as limits for temperature rise, high-pressure tests, and other features by the B.E.A.M.A. Committee differ very little from the values now assigned by the Engineering Standards Committee. It is rightly pointed out by Mr. Everest that this is the best possible testimonial to the thoroughness of the Association's preliminary work, and of the painstaking efforts of every member of the Committee to which that work was entrusted.

THE ELECTRICAL BARRICADE BETWEEN BELGIUM AND HOLLAND

THE Dagblad van Noord-Brabant publishes an interesting description of the high-tension "electrical barricade" which the Germans have erected between Belgium and Holland to prevent unauthorised crossing of the frontier by the unhappy people of the former country.

Seen at a distance, this resembles a hedge formed of wires and posts. One can see from far off notice-boards upon which the Germans have inscribed in three languages: "High-tension current: Risk of death." The barrier is formed of seven wires fixed on white insulators. The five middle wires, covering a height of about two metres, are attached to oak stakes driven into the ground, and on either side of these are thicker wires on oak poles—probably the feeders. The pressure employed is 2,000 volts. At each side of the conductors and about half a metre from them are a series of four protecting wires to protect people from coming against the charged wires by chance, so that contact with the live wires is only made if anyone tries to climb over.

Death from Electric Shock.—At the works of the Lancashire Ordnance Company, Heaton Norris, last week, a workman received a fatal electric shock in rather peculiar circumstances. A number of men were lifting an electric motor with chain blocks, when one of the chains came into contact with a cable running on an insulator close by. The cable was insulated, but at the point of contact with the insulator the insulation had come away, with the result that the man received an electric shock through the chain. The voltage was said, at the inquest, to be about 286 volts.

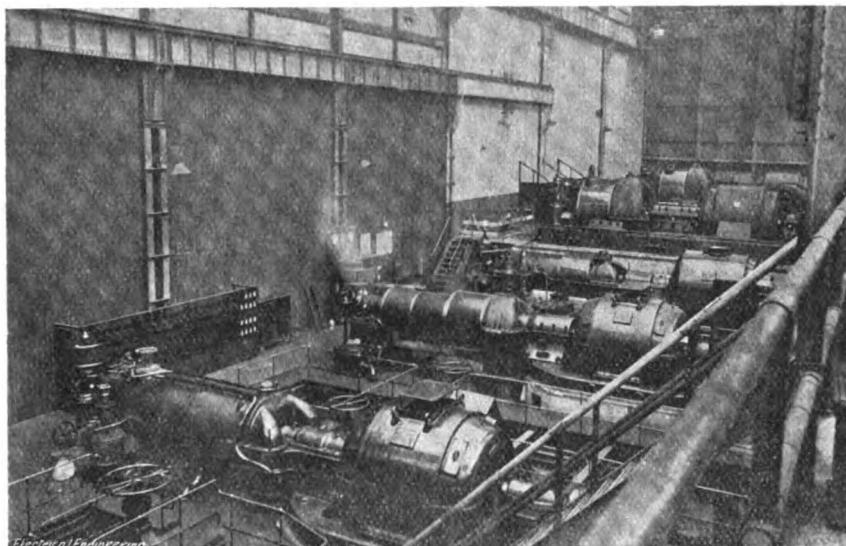
More Osram Strength.—The marvellous strength of Oram drawn-wire lamps has been demonstrated in the most practical manner many times, but there are few more striking examples of Osram strength than the one here recorded. During the Zeppelin raid in London on June 4th a house was so badly wrecked as to render its being pulled down and completely reconstructed. Two years ago the place was fitted with electric light, and a dozen 32-c.p. Osrams installed. All these lamps were found intact after the attack, although the opal shades were smashed to fragments.

Explosives.—In his Presidential Address to the Association of Engineers-in-Charge last week, Mr. Frank Bailey, joint managing director of the City of London Electric Lighting Co., chose explosives as his theme. He gave an interesting survey of the history of fulminates, propellents, and fillers, and referred to the unfortunate early history of guncotton, which at first a most unstable mixture, was subsequently made one of the safest of explosives.

Birmingham and District Electric Club.—Following the decision at the Annual Meeting last year, it has been decided to hold a dinner in honour of the new President, Mr. W. G. L. Riddle, on Saturday, Oct. 23rd, at the Swan Hotel, New Street.

EXTENSIONS AT STEPNEY ELECTRICITY WORKS

THE first section of the Limehouse generating station of the Stepney Borough Council was put into operation in the autumn of 1909, and since that date the demand for electricity has grown at such a rapid rate that considerable extensions have become necessary. As early as June, 1912, the Borough Electrical Engineer and Manager, Mr. W. C. P.



VIEW OF ENGINE ROOM.

Tapper, M.I.E.E., was instructed to report on the question. He presented a report advising the doubling of the station buildings and the immediate installation of two 5,000-kw. turbo-generators, together with the necessary boilers and auxiliary plant, at an estimated cost of £197,750. The report was adopted, and the work has been carried out and recently completed. The new plant was officially inaugurated on Thursday last, when the Mayor of Stepney, Mr. H. T. A. Chidgey, J.P., started up one of the new turbo-generators.

The very rapid growth of the power demand is shown by the following figures :—

| | |
|---|--------|
| H.p. of motors connected Sept. 30th, 1911 | 9,987 |
| " " " " " 1912 | 13,220 |
| " " " " " 1913 | 15,797 |
| " " " " " 1914 | 17,821 |
| " " " " " 1915 | 21,623 |

The extension to the buildings has been carried out upon the same lines as the original buildings, viz., in ferro-concrete. The contractors for the execution of the work were Messrs. Drew-Bear, Perks & Co., of Battersea, S.W.

The new boiler-house installation comprises four water-tube steam boilers by the Howden Boiler Co., Ltd. The specification calls for a normal evaporation of 33,000 lb. of water at 150° F. to steam at 200 lb. pressure per hour per boiler, with a heating surface of 6,700 sq. ft. and 190 sq. ft. grate area. Each boiler is in six elements, with upper and lower drums connected together with about 6,700 vertical tubes all 2 in. in diameter, and the necessary balancing water and steam pipes between the drums. Each element is provided with a safety valve, and there are two feeds to each boiler. Each boiler is fitted with internal superheaters, and is complete with all the necessary external platforms and ladders. The whole of the steam fittings are of Messrs. Hopkinson's make.

The stokers (two to each boiler) are of the Underfeed Stoker Co.'s moving-grate type, and are worked in conjunction with their hot-air economisers, forced draught, and Messrs. Prat's patent induced draught chimneys, with the object of obtaining as nearly as possible a balance draught at the stoker-grate level. These economisers, two to each boiler, are placed in the flue immediately

above the boiler and under the chimney. To each boiler there is an induced draught fan and motor and forced draught fan and motor, these being mounted above the level of the top of the boiler upon platforms close to the bases of the "Prat" chimney. At a convenient height above the boiler-house floor level each boiler is provided with a gauge board, upon which are mounted the following instruments :—The steam gauge, two superheat gauges, the forced draught motor ammeter, shunt regulator and draught gauge, the induced draught motor ammeter, shunt regulator and draught gauge, and the balanced draught gauge. This arrangement enables the stoker to have the working conditions of the boiler always under observation. The stoker drive is suspended on the under-side of the boiler-house floor and operates patent spring clutch gear to give motion to the grates.

The coal-handling plant extension consists of a double mono-rail telpher track running over the tops of the coal bunkers, and one track extends for twenty feet into the yard at the north end of the building.

A new telpher, of Messrs. Strachan & Henshaw make, has been added in order to cope with the increasing coal supplies, and to ensure continuous working in the event of a breakdown to either telpher machines.

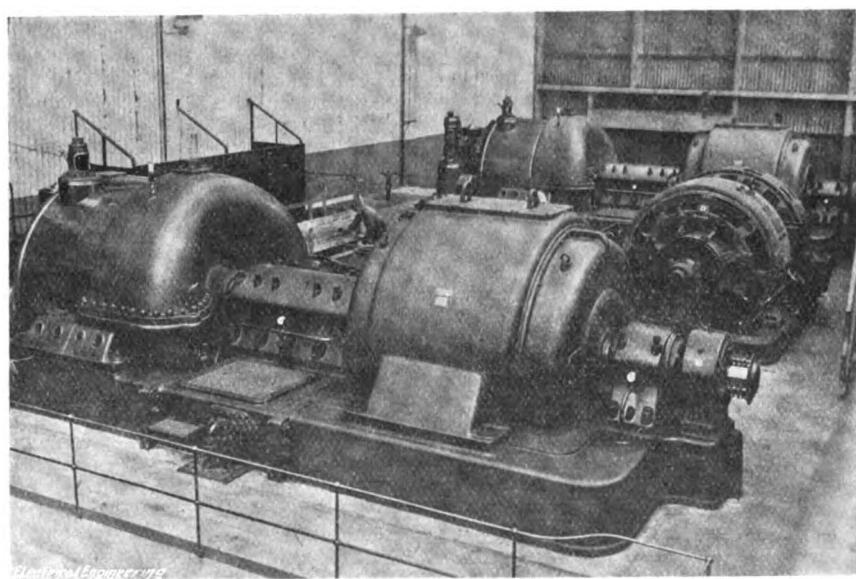
For handling the coal stock at the north end of the boiler-house a three-ton electrically-driven jib crane, manufactured by the Chatteris Engineering Works Co., of

Chatteris, Cambridge, has been erected, with a maximum working radius of 45 ft. A coal receiving and discharge hopper is provided in the yard at the end of the telpher track.

In the existing boiler feed-pump room has been installed a Weir steam turbine-driven feed pump, having a capacity of 10,000 gallons of water per hour against a pressure of 250 lb. per sq. in.

The exhaust steam from the turbine is turned direct into the hot well overhead through a kinetic heater.

The engine-room extension, of which a general view is given in our first illustration, consists of two 5,000-kw. Escher-Wyss turbines of the Zoelly impulse type, coupled to two Brown-Boveri three-phase alternators, 6,600 volts between phases at 50 periods. These sets are capable of generating 25 per cent. overload for two hours and 50 per cent. overload



NEW ESCHER-WYSS-BROWN-BOVERI TURBO-GENERATORS.

for half an hour, running at a speed of 1,500 revolutions per minute. The working steam pressure is 180 lb. at the stop valve at a temperature of 500° F. The contract figure for the full load steam consumption at unity power factor is

13.31 lb. per kw.-hour, subject to a tolerance margin of $\frac{1}{2}$ per cent.

An interesting feature of the installation is the attachment to the alternators of Heenan & Froude air filters, each capable of cooling and cleansing 25,000 cubic ft. of air per minute. These filters are of the rotary type, the lower half of the sheet cylinder being in water. The air comes in contact with water in the form of a thin film, and is delivered at the filter outlet in a natural condition after the dust and impurities of the air have been eliminated. The filters are placed in the basement, and the necessary water supply for them is led from the condensing plant.

Two surface condensers of Messrs. Escher, Wyss & Co.'s make are erected immediately below the turbines, each having 10,760 sq. ft. of cooling surface, with wrought-iron cylindrical shell, drawn brass tubes, tinned and rolled brass tube plates.

The pumping plant for each set, which is placed in the basement between the main turbine foundations, consists of one steam turbine-driven circulating water centrifugal pump, rotary air pump, condenser extraction pump, and hot well force pump, all mounted upon one bedplate and coupled in line to one shaft, running at a speed of 2,000 revolutions per minute.

It is so arranged that the steam from these auxiliary turbines can be either turned into a stage of the main turbine or into the hot well by means of a Holden & Brooke kinetic heater, thus in the latter case regaining the latent heat units of the steam.

The condensing arrangements are such that either condensing plant can be used with either turbine, or in case of emergency both turbines could be run on reduced loads upon one or other of the condensing plants. Furthermore, the exhausts from the main turbine have been so arranged that the turbine can exhaust to atmosphere in the event of a sudden failure of the condensing plant.

A 50-ton overhead electrically-driven crane has been erected by Messrs. Stothert & Pitt, of Bath. This crane is provided with a slow hoisting motion, capable of dealing with loads from 5 tons to 50 tons at a lifting speed of from 2 to 6 ft. per minute, and a quick motion for dealing with light loads up to 5 tons at the rate of 20 to 40 ft. lift per minute. There are three motors, each running at 700 revolutions per minute, one for lifting, one for travelling, and the third for hoisting.

Upon the new engine-room floor level, and between the two 5,000-kw. alternators, has been erected a Bruce Peebles 1,000-kw. motor-converter. This machine is similar to other machines of this firm's make, several of which have already been installed and in operation for some years in the generating station and sub-stations.

In order to secure greater safety in running of the motor-driven auxiliary plant, alternator field excitation, and pilot lighting of the station, a battery of 260 cells has been installed. The capacity of the battery is 500 ampere-hours for one hour, and it has been installed by the D.P. Battery Co., of Bakeswell. For charging this battery, a combined battery booster and feeder booster of Messrs. Siemens' make, together with the necessary switchgear, have been added to the plant. Under normal conditions the battery will be floating across the main D.C. bus-bars. Should the main bus-bar supply from any cause fail, or the pressure drop abnormally, the rush of current from the battery brings out a pair of three-way overload breakers, one in the positive side and one in the negative side of the system, instantaneously cutting the battery off the bus-bars and leaving it on the auxiliary power circuit. In addition, should the motor of the booster set be cut off from the supply, and allow the boosters to race upon a weak field, change-over switches are operated by a pair of relays coupled across the brushes of the motor, thereby cutting out the boosters.

Upon the new switchboard gallery, which immediately overlooks the turbo-alternator sets, have been placed six panels of Messrs. Reyrolle's new type extra-high-tension ironclad gear, and also the rheostat regulating gear for the alternator fields. The above gear includes two machine switches, two bulk-supply panels, and two coupling switches. Following upon the original lines there are duplicate three-phase bus-bars, the section of each bar being 1 sq. in. The switches are contained in boiler-plate tanks with cast-steel tops.

The whole of the circuits to and from the switchgear are protected with Merz-Price protection. In addition, the generator panels are provided with rotary type field switches with an electrical interlock between them and the main switch. This interlock prevents the field switch from being opened before the main switch, and provides for the automatic tripping of the field switch when the main switch operates, and ensures that the field switch is closed before the main switch. The fields of the exciter are separately excited at 240 volts from

the L.T. D.C. supply. These panels are also provided with all the necessary synchronising sockets, signal lamps for "switch on" and "switch off," power factor indicators, and open-dial type ammeters and wattmeters for each phase.

In addition to this switchgear, a Brown-Boveri automatic field regulator has been furnished for each alternator, and an electrical controlled governor switch for each turbine to regulate the speed direct from the gallery.

In order to cope with the increase of load and the bulk supply demands from Shoreditch and Bethnal Green, the following additional feeders, converter, and switchgear have been provided:—Two 1,500-kw. E.H.T. feeders laid from the Limehouse generating station to the Whitechapel sub-station; two 1,500-kw. E.H.T. feeders laid from the Whitechapel sub-station to Shoreditch; two 1,500-kw. E.H.T. feeders laid from the Whitechapel sub-station to Bethnal Green. All these feeders have been provided with pilot cables for Merz-Price protection gear. E.H.T. Reyrolle switchgear has been added to the respective sub-station switchboards to control these feeders.

ELECTRICITY CHARGES

THE general tendency on the part of electricity supply authorities to increase their charges owing to higher working costs raises a question of some interest concerning municipal electricity undertakings. As a general business proposition an increase in working costs must necessarily be reflected in the selling price of the article, and electricity supply is no exception to this. Certain factors, however, come into play when dealing with municipal trading which have the effect of putting these undertakings on a somewhat special footing.

Municipal supply station engineers as a body desire nothing more than that their undertakings should be run on orthodox business lines, but, of course, their environment to a large extent prevents this. In the larger undertakings the effect of this environment is less felt than in the smaller ones, as the profits made are sufficient to enable reasonable reserve funds to be built up, to pay away amounts to the relief of rates and frequently to retain a certain amount as working capital. It is noteworthy also that only a few of the larger and more important undertakings have increased their charges up to the present. Their financial stability is such that they can continue to sell at the old tariffs. With the smaller undertakings, however, the position is somewhat different, as it is usually impossible to provide for a reserve fund and at the same time to relieve the rates out of the profits. The rule has been rather to sacrifice the reserve fund in favour of rate relief, and the full effect of this offence against economic laws is now manifesting itself. In all parts of the country there are undertakings whose margins of reserve are so small—in some cases nil—due to the policy of allocating sums to relief of rates instead of keeping the money in the undertaking, that they are unable to meet even a portion of the present temporary extra cost of coal and labour. Surely that is the object of a reserve fund, and where undertakings have contributed to the relief of rates the consumer has just cause for complaint if the whole of the present increased cost of working is put upon him.

Another matter is that of public lighting supplied from municipal electricity works. The cost of this, of course, is a burden which is shared by the ratepayers as a whole. There are cases where compulsory reduction of the public lighting and its inevitable effect upon the electricity department revenue is one of the reasons put forward for increasing the charge to the ordinary consumer. Seeing, however, that the general body of ratepayers presumably benefit from the reduced cost of public lighting, should the loss in the revenue to the supply department be made up wholly by increasing the charge to the consumer of electricity for other purposes? One section of the ratepayers are thus being made to benefit another section in a matter in which both should share equally. The advantage the consumer gets by way of reduced rates—if any—due to less street lighting, he has to pay back to the electricity department in his higher bill. The question of rate relief is also mixed up in this, for it may well be argued that where this policy is adopted, electrical energy has not been sold at as low a charge as might be; in any case, the undertaking, and consequently the consumer, must suffer somewhere.

In view of the necessity of keeping the charges for electricity supply as low as possible in the times in which we now live, we think the points mentioned above are worthy of consideration by those municipalities who are affected by them.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,465.

A 20 h.p. D.C. motor has its armature lap wound with six conductors per coil, arranged in the slot in this order: 1, 2; 3, 4; 5, 6; i.e., two side-by-side and three deep per coil. In replacing a faulty coil the conductors may have been connected to the commutator so as to change their order numerically in the same slot thus: 2, 1; 6, 5; 4, 3. Would this change be detrimental to the running of the machine, enough to cause sparking?—"BOOSTER."

(Replies must be received not later than first post, Thursday, October 28th.)

ANSWERS TO No. 1,463.

How are the values of resistances for a controller for a 585 h.p., 485 r.p.m., 2,200-volt, 25-cycle, three-phase slip ring induction motor obtained? Rotor star connected, 700 volts, standing 360 amperes full load. The controller to have 12 stops. Is it standard practice to cut resistance first out of *B*, then *R*, then *Y* phase, and repeat until finally short-circuited, or to cut resistance out of all three phases together? If the former method is used, would it have an unbalancing effect on the rotor on any step, and tend to make it hunt, as one phase would be loaded more than the others? How would the resistance be calculated to give any particular speed on any particular step?—RESLETT.

The first award (10s.) is given to "Y. Z." for the following reply:

This question is really three in one, and the second should be answered first, as it explains the basis on which the information asked for in the first part is based. It is standard practice with some switchgear makers to cut resistance out of only one phase at a time as described in the question, as this method reduces the total number of contacts required in the starter, and only one set of contacts is required instead of three, so that the controller is simplified. The method is perfectly justifiable in many cases, although it undoubtedly does introduce unbalancing and possible bad starting under adverse conditions, since the total resistances in the three legs of the rotor will usually be unequal, resulting in an equilateral voltage being impressed on a triangle of resistance which is not equilateral. It is justifiable in the case of small motors particularly, as the starting period is in their case usually a short one, and irregularities during its course are not so important as in the case of a large motor, such as the question deals with. This is more essentially a case for maintaining an equal resistance always in each of the three legs of the rotor, as the third part of the question suggests that speed regulation may have to be done by means of the rotor starter, and in such a case it is obviously unwise to run any chance of unbalancing if the motor has actually to run at a reduced speed in actual working.

It is assumed, therefore, in what follows, that there will be three resistances all alike, one for each rotor leg, and that there will be 12 stops on each resistance, making 12 actual stopping positions between the "all in" and "all out" positions.

Come now to the first part of the question. The rotor

generates 700 volts between rings at standstill, which is 405 volts per phase. The total resistance per phase, including external and internal resistance, is given by dividing 405 by the rotor current per phase, which is permissible on the first step of the starter. If full load current were permissible then, the required total resistance per phase would be $405/360 = 1.125$ ohms.

As, however, it is unlikely that the supply would stand so large a demand all at once, it would probably be good practice to limit the demand on the first step to, say, one quarter of full load. Assuming that rotor current and load are proportional, which is true enough for the present purpose, this means a current per phase in the rotor of 90 amperes. Thus the required total resistance per phase is $405/90 = 4.5$ ohms. The resistance per phase of the rotor winding is not given, but it can be deduced. The speed is given as 485 at full load, which implies a slip of 3 per cent. The rotor generates 405 volts per phase at 100 per cent. slip, and hence at 3 per cent. slip it generates 12.15 volts. The current at full load is 360 amperes, and hence the resistance per phase is $12.15/360 = 0.03375$ ohms. The 3 per cent. given for slip is probably rather high, and the rotor resistance may, for the purpose of simplicity in calculation, be taken as .030 ohms per phase. Thus when the external resistance is "all out," the rotor circuit has .030 ohms per phase, and when the external resistance is "all in" the total is 4.500 ohms per phase.

Now it is as obvious as it is well known that a grading by means of a geometric series between the two extreme values of resistance gives the most even possible increments of current throughout starting. In this case, therefore, we have to start at .030 ohms, and in 12 steps arrive at 4.500 ohms by using a constant multiplier to pass from one step to another. Now $4.500/.030 = 150$, and the twelfth root of 150 is therefore the multiplier required. This root is 1.52, which means that the rise of current in passing from one step to another will be 52 per cent. always. The series is then as follows:—

| Step No. | Total Resistance in Circuit at this Step. | Resistance between Steps. | Amperes if Starting on full Torque. |
|----------|---|---------------------------|-------------------------------------|
| 0 | 0.30 | — | 550/360 |
| 1 | .046 | .016 | 550/360 |
| 2 | .069 | .023 | 550/360 |
| 3 | .105 | .036 | 550/360 |
| 4 | .160 | .055 | 550/360 |
| 5 | .243 | .083 | 550/360 |
| 6 | .367 | .124 | 550/360 |
| 7 | .559 | .192 | 550/360 |
| 8 | .850 | .291 | 475/360 |
| 9 | 1.290 | .440 | 313 |
| 10 | 1.960 | .670 | 206 |
| 11 | 2.970 | 1.010 | 136 |
| 12 | 4.500 | 1.530 | 90 |

4.470 = total resistance per phase in starter only.

On the assumption that the motor does not start until full current is reached, the current up till that point is simply 405 divided by the total resistance per leg as shown. After starting, the current settles to 360 each time if due time be allowed for accelerating, and rises momentarily to $1.52 \times 360 = 550$ on cutting out the next step. If the start be against less than full torque the motor begins to run earlier, and the current will rise always to 1.52 times the running value on cutting out a step, after motion has begun to take place. The above grading appears to be fairly suitable, allowing the motor to start on the fifth step, and allowing about two-thirds of the steps for the acceleration up to full speed. This is the worst possible case, too, unless the starting torque is in excess of full-load torque, in which case 12 steps is scarcely a sufficient number. It will be noted that the voltage between contacts never exceeds about 140 ($= 90 \times 1.52 = 136 \times 1.010$, &c.), and this should not be excessive for an oil-immersed switch, as this would presumably be.

If for any reason a considerably less voltage than 140 is desired, the number of steps must be increased suitably, but if only slightly less be considered desirable, then some resistance can be taken out of the steps near the starting end, and distributed amongst the steps near the running end; but this will of course increase the current increments at the latter end. On the whole, the true geometrical grading would seem to meet this case well.

The third column of the table gives the resistance to put in each step, and the fourth states the current that will have to be carried by that step on the assumption of full-load torque at starting. This furnishes complete particulars for designing the resistance. The form it takes will depend on whether it is

to be oil-immersed or not, whether wire or grids or some other material is to be used, and this can be left to be decided on the merits of each individual case. It should be noted that the resistance can be harder run near step 12 than near step 1, as the latter is in right up to the end; and the amount by which the wire can be overrun, if the controller is for starting only, will depend on the length of time starting is to occupy, whether the resistance be oil-immersed or not, and other conditions so impossible to assume without further knowledge that no very safe general rule can be given.

Turn now finally to the third part of the question, which indicates that the resistance may have to be used for speed regulation. In such a case, of course, it would have to be designed to carry its current continuously on as many steps as are to be used for that purpose, and the remarks above about the rating of the resistance for starting purposes would apply only to such portions as are used for starting only. For the calculation of the resistance for a particular speed less than the running speed it is necessary to know the torque which has to be exerted, as this determines the rotor current at which the necessary voltage is to be absorbed in the resistance. At any particular speed the rotor is generating a definite voltage, and the resistance must be such that this voltage will just allow enough rotor current to flow to balance the external torque. Thus suppose the rotor is to run at 80 per cent. of full speed, say 388 r.p.m. This is a slip of $500 - 388 = 112$ r.p.m. Now a slip of 500 r.p.m. generates 405 volts per phase, so a slip of 112 r.p.m. will generate $112/500$ of 405 = 90 volts per phase. At full-load current this means a total resistance per phase of $90/360 = .25$ ohms, or an external resistance of .22 ohms. For half of full-load torque, a total resistance of .50 ohms, and an external resistance of .47 ohms is necessary, and so on for any other case.

It must be noted that if any particular range of speed is required, the geometric grading on that part of the controller will very likely have to be departed from, and some compromise effected in regard to the value of successive steps. This may upset other points, such as current increment, or volts between steps, and it may become necessary under certain conditions to increase the number of steps should the controller have to fulfil the double function of starting and regulating under full-load torque conditions.

It is to be noted that, in the above treatment of the points raised in the question, some assumptions have been made which may not be strictly theoretically correct, such as that the rotor impedance can be added, arithmetically, as a resistance to the external resistance throughout. How far this disturbs the result can be seen for each case separately, but the approximations which have been introduced have the merit of leading to an extremely simple treatment, and have no bad effect on the starter or controller calculated as indicated. The method described does, in fact, give good results in practice, and that, after all, is the only condition which need to be fulfilled when the case is a purely practical one, as this is.

The second award (5s.) is made to "ALPHA" for the following reply:—

The total value of starting resistance will depend upon the amount of current rush permitted at the moment of switching on. Since this point is not mentioned in the inquiry, it will be assumed that there are no restrictions imposed by the supply company in this case, and that the usual practice of allowing full-load current to flow on the first step may be followed. Since full-load current in the line corresponds to full-load current in the rotor, and the rotor voltage per phase = $\frac{700}{\sqrt{3}}$ = 405 volts, the total resistance per phase will be $\frac{405}{360} = 1.125$ ohms.

The full-load speed of the motor is given as 485 r.p.m., corresponding to 3 per cent. slip, so that the resistance per phase of the rotor itself is $1.125 \times 0.03 = .034$ ohms. The external resistance will therefore be $1.125 - .034 = 1.091$ ohms per phase, or 3.273 ohms total. The resistance will be star connected, and on a motor of this size it is probable that the first stop of the controller will be arranged to connect the stator windings to the line with only two of the resistance legs joined, the second stop joining up the third leg in Y, and the fourth and succeeding steps short-circuiting portions of the starting resistance, in accordance with the usual practice. With a controller having 12 stops this means that the resistance will be divided into ten parts. The divisions must be so made that the ratio of the total resistance (including the rotor windings) on any one stop to that on the next stop is constant. The required ratio is found from:—

$$n \log A = \log (R+r) - \log r,$$

where n = number of portions into which the external resistance is divided,

R = total external resistance,

r = total resistance of rotor windings.

In the present case this gives $A = 1.42$.

The total resistance (external + rotor) in circuit on each stop

is found by dividing that on the preceding stop by this ratio, and the value of each division by subtracting successive steps as shown on the following tabulation:—

| Controller Stop. | Total Ohms. | Ohms Per Division. |
|------------------|----------------------------|--------------------|
| 1 | One leg open. | |
| 2 | 3.375 | Resistances in Y |
| 3 | 2.38 | .995 |
| 4 | 1.68 | .7 |
| 5 | 1.18 | .5 |
| 6 | .83 | .35 |
| 7 | .58 | .25 |
| 8 | .41 | .17 |
| 9 | .29 | .12 |
| 10 | .21 | .08 |
| 11 | .15 | .06 |
| 12 | .102 (rotor windings only) | .048 |

It is standard practice to cut out resistance from each phase in turn. This causes some slight unbalancing, but not sufficient to affect the operation of the motor in any way, except to slightly increase the heating.

The speed of an induction motor depends on the torque exerted as well as the resistance in the rotor circuit. In practice the slip (i.e., the difference between the synchronous speed and the running speed), may be taken as proportional to the total resistance in the rotor circuit, and to the torque exerted, bearing in mind that there is a certain "pull-out" torque (say about three times full-load torque) above which the motor will not carry the load, but will be "stalled," and that as this torque is approached the slip increases more rapidly than the load. The full-load speed of this motor is given as 485 r.p.m., and the synchronous speed will be 500 r.p.m. The slip with full load torque and a resistance (rotor windings only) of .102 ohms (.034 ohms per phase) is therefore 15 r.p.m. = 3 per cent. If the motor is required to run at, say, two-thirds speed with full-load torque, the slip will be 167 r.p.m. = 33 per cent., and the total resistance in the rotor circuit must be $102 \times \frac{33}{3} = 1.122$ ohms. The nearest stop to this would be No. 5 on the above tabulation, 1.18 ohms, which would give a speed of 326 r.p.m., the slip being $1.18 \times \frac{174}{500} = 174$ r.p.m. This would presumably be near enough to the required speed, especially as the speed would change with every variation in the load—thus at half full-load torque the slip would only be approximately $\frac{174}{2} = 87$ r.p.m., giving a speed of $500 - 87 = 413$ r.p.m. It is evident from this that it is impossible to keep an induction motor running at a steady reduced speed by resistance in the rotor circuit, unless the load can be held dead constant.

If the resistances are for continuous speed regulation they must of course be designed to carry the full-load rotor current continuously. If for infrequent starting service only, a common rule is to allow full-load current for half a minute on the first stop, and one minute on the last, the intermediate resistances being graded between these limits. This is, of course, governed by the length of time which the motor takes to run up to speed, and the frequency with which it must be started.

The insulation between the grids and the frame of the resistance should be designed for the full rotor voltage (700 volts).

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"An Introduction to Applied Mechanics." By E. S. Andrews. 316 pp. 9 in. by 5½ in. 205 figures. (Cambridge : The University Press.) 4s. 6d. net; abroad, 5s.

"A First Course in Engineering Science." By P. J. Haler and A. H. Stuart. 191 pp. 7 in. by 5 in. 159 figures. (London : W. B. Clive.) 2s. 6d.; by post, 2s. 9d.

"Experimental Physics : A Text-book of Mechanics, Heat, Sound, and Light." By H. A. Wilson. 405 pp. 8½ in. by 5½ in. 235 figures. (Cambridge : The University Press.) 10s. net; abroad, 10s. 7d.

"Elementary Lessons in Electricity and Magnetism." By S. P. Thompson, F.R.S. 744 pp. 6½ in. by 4½ in. 377 figures. (London : Macmillan & Co., Ltd.) New edition. 4s. 6d.; abroad, 4s. 11d.

"Table of Compound Interest at 1 per cent. and of Anti-logarithms to Base 1.00125. By J. J. Stuckey. 117 pp. 9½ in. by 7½ in. (London : George Allen & Unwin, Ltd.). 21s. net; abroad, 21s. 6d.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 14th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

20,728/14. Heating Elements. G. H. AND H. F. COLLINS. A heating element comprising a former of straight formation and of curved cross section, having transverse ribs upon its outer surface following the curve, and forming parallel recesses and a coiled resistance wire laid backwards and forwards in the recesses so that a large portion of the curve is in contact with the material of the former which is caused to glow. (Four figures.)

23,189/14. Accumulator Charging. H. F. JOEL. An accumulator charging contact apparatus which when the cell is placed in position for charging automatically cuts out of circuit a resistance equivalent to the cell, and when the cell is withdrawn restores the resistance to the circuit. (Thirteen figures.)

7,270/15. Meter Compensation. E. FAWSETT. A temperature compensating device for induction type meters, consisting of correcting bands or shading coils round the poles having a negative temperature coefficient of resistance. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: SMITH and OWEN [Conduit joints] 20,254/14; WILLIAMS, WARWICK and ANCHOR CABLE Co. [Junction boxes, &c.]

Ignition: DAIMLER-MOTOREN-GES. [Sparkling-plug] 9,783/15.

Instruments and Meters: LANDIS & GYR S.A. [Prepayment meters] 20,458/14; WESSEL [Hot-wire current limiters] 4,987/15.

Switchgear, Fuses, and Fittings: SCHMIDT [Switches for simultaneously operating electric light and camera shutters] 20,295/14; TRIER [Automatic regulators] 23,368/14.

ELECTRIC TRACTION NOTES

An interesting point was raised last month during the debate on a vote for extending the electrification of the Gothard Railway to the Erstfeld-Bellinzona section. Although at the moment there is no war between Germany and Switzerland, it was suggested that the question of liability to aerial attack might be considered. It was argued that aircraft could easily destroy the large power-houses such as those at Göschenen, Wassen, or Amsteg, and so paralyse a large portion of the Swiss railways, and that perhaps, in the circumstances, the policy of extending the electrification to further lines might be reviewed with this possible contingency in view. It is doubtful, however, whether the argument is a sound one. From recent events in this country it is clear that aircraft, flying at great heights to render it less liable to destruction, has necessarily a very poor aim. With the mountain protection of Switzerland even greater heights might be necessary if the aircraft enjoyed immunity from destruction, and it is therefore more than probable that the power-houses would not be so good a target as the lines themselves.

A meeting of the Metropolitan Association of Electric Tramway Managers was held on Friday, the 15th inst., at the Municipal and County Club, Whitehall Court, S.W., when the following were present:—Messrs. Ullmann (East Ham), Chairman; Schofield (Leyton), Vice-Chairman; Moffet (West Ham), Mackinnon (London United), Hammond (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), Hon. Secretary. Messrs. Ullmann and Schofield were re-elected Chairman and Vice-Chairman respectively, and Goodyer re-elected Hon. Secretary.

In view of the difficulty experienced in obtaining supplies

Telephony and Telegraphy: OLSSON and PLEIJEL [Telephone reflectors] 22,937/14.

Traction: SOC. ANON DES ETAB. L. BLERIOT [Car lighting] 16,080/14.

Miscellaneous: KNIFE and READ [Electric welding] 20,176/14; SCHIESSLER [Relays] 20,238/14; CLARK [Roentgen-ray bullet localiser] 20,595/14; ROBERTSON, BOWMAN, and RINGROSE [Colliery signalling] 21,637/14; JONES [Arc soldering] 21,822/14; CURTIS and IGRANIC ELECTRIC Co. [Electromagnetic valves] 21,824/14.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Miscellaneous: BRITISH WESTINGHOUSE Co. [Control systems] 12,340/15; QUARTZLAMPEN GES. [Treatment of liquids by radiation from quartz lamps] 13,624/14.

Restoration of Lapsed Patent

17,817/07. Filament Mounting. A. C. HYDE. An order has been made for the restoration of this Patent, which had been allowed to lapse. The specification describes a method of attaching metal filaments to leading-in wires by applying a metallic paste, and subsequently heating locally by an electric arc in hydrogen.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, and TRANSFORMERS: B.T.-H. CO. (G.E. CO., U.S.A.) [Motor control] 13,380/05; M. LATOUR [A.C. motors] 14,697/06; A. G. BROWN, BOVERI ET CIE. [D.C. rotary transformers] 13,092/08; J. C. B. INGLEBY [A.C. armatures] 13,719/08.

Instruments and Meters: SCHOTT & GEN [Electrolytic meters] 14,288/09.

Switchgear, Fuses, and Fittings: W. FAIRWEATHER (Benjamin Elect. Mfg. Co., U.S.A.) [Cluster lamp-holders] 13,425/05; J. G. STATTER [Switches] 14,577/06; B.T.-H. CO. (G.E. CO., U.S.A.) [Motor-starters] 15,262/07; R. C. LYNESS [Switches] 15,151/09.

Telephony and Telegraphy: KØBENHAVNS TELEFON-AKTIESELSKAB [Automatic telephones] 14,851/06; F. RITCHIE [Telautograph current regulator] 13,957/08.

Traction: H. LEVNER [Train lighting] 15,325/09.

of steel tyres and other materials at the present time, to which reference was made at the annual meeting of the Tramways & Light Railways Association (ELECTRICAL ENGINEERING, September 30th, p. 398), the Council has appointed a Special Committee to deal with the matter, consisting of Mr. Harry England (Vice-Chairman), Mr. Fred Bland, and Mr. J. B. Tippetts. Members are invited to communicate with the Secretary and give particulars of the difficulties they are encountering.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The Western Electric Co., Ltd., have sent us a copy of the Western Electric News "Extra" in connection with the recent successful experiments in wireless telephony in America. The Western Electric News is a magazine published by their American firm. The long-distance wireless telephony experiment has already been briefly referred to in this column. Mr. Vail, President of the American Telephone & Telegraph Co., spoke by wireless from Arlington, Virginia, to Mare Island, Navy Yard, San Francisco, to Mr. J. J. Carty, the Company's Chief Engineer, over a distance of 2,500 miles on September 29th, and speech was clear. Certain sentences were spoken, and Mr. Carty repeated them back accurately over the trans-continental wire lines which were formally opened last January. The test was the combination of many months of experiments and tests. The officials of the Army and Navy communicated by wireless in the same manner with success, representatives of the Army Signal Corps and the Technical and Operating Departments of the Navy Department being present.

"ELECTRICAL ENGINEERING" TRADE SECTION

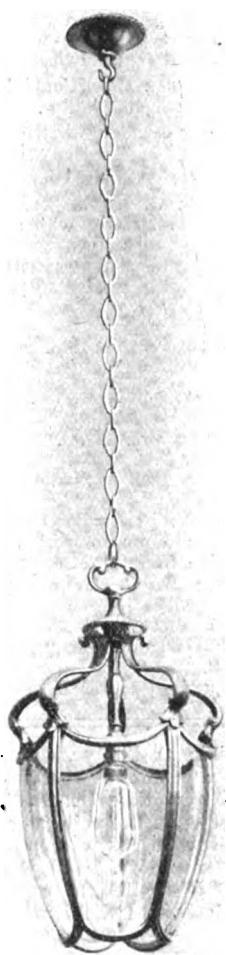
"EDISWAN" ELECTRIC LIGHT FITTINGS

A NEW catalogue of artistic electric light fittings has been issued by the Edison & Swan United Electric Light Co., Ltd. The Company announces that in consequence of a largely increased turnover for fancy fittings, they have decided to keep a larger assortment of stock designs. The new list is accordingly considerably enlarged, comprising nearly 200 pages with 500 handsome illustrations on art paper. At the back of the book is enclosed a quantity of introduction slips

of travelling 35 to 45 miles on a single charge, the average speed being about 10 miles an hour.

The battery, which is compactly mounted under the driver's seat, consists of 42 cells of the Philadelphia Storage Battery Co.'s traction type, with a total capacity of about 105 ampere-hours. It is fitted with an Anderson charging plug for charging in position, but it is so mounted as to be easily removable in three sections if it is desired to do the charging separately.

The motor is a 3-h.p. Westinghouse motor, four-pole, and runs normally at 80 volts, 600 r.p.m. It is placed in the



EDISWAN ELECTROLIER.



CEILING FITTING.



ARTISTIC BRACKET.

(with counterfoils) for contractors' use—a very good idea. A wide range of fittings is described, including pendants suitable for bedrooms and billiard-rooms, various styles of brackets, ceiling fittings, electroliers in "Sheraton," "Flemish," and "Georgian" styles, hall lanterns, &c. The shades for indirect and semi-indirect lighting are interesting in view of the development of high candle-power incandescent lamps.

The catalogue is a very artistic production, and will no doubt be much appreciated by users of fancy fittings. Any of the fittings illustrated can be seen at either of the Company's showrooms at 123 Queen Victoria Street and 71 Victoria Street.

"WARD SPECIAL" ELECTRIC VEHICLE

WE have had the opportunity of inspecting a well-constructed and compact form of electric delivery van by the Ward Motor Vehicle Co., of New York, who are introducing it into this country through the Krieger Electric Carriage Syndicate, Ltd., (48A Gillingham Street, S.W.). The car is built to carry a normal load of 750 lb., and is capable

centre of the chassis, and drives through a propeller shaft to the rear axle. It is series wound and controlled so as to start with the four field coils in series, and to run normally with the coils in two parallel groups. Starting resistances of the grid type are provided, and there are four speeds ahead and two reverse. The resistances and controller are placed under the footboard.

Although light in appearance, the car appears to be of robust design and construction, and will probably prove a successful competitor in its particular field.

THE B.E.A.M.A. JOURNAL

THE October number of the quarterly journal of the British Electrical and Allied Manufacturers' Association contains little in the way of official announcements or direct references to the activities of the Association itself. It includes, however, several articles of intrinsic interest. The most important of these, dealing with the new British standardisation rules for electrical machinery, is quoted at some length on page 424 of this issue. Other signed articles are "The

Organisation of Electrical Publicity," by A. G. Whyte; two polemical articles on the I.M.E.A. Bill, from opposite points of view, by H. Faraday Proctor and "A Member of the E.C.A.;" "Home Buying after the War," by Thomas Roles, written in response to an invitation which might very well have been refused; and a technical article on the control of A.C. motors by Frank Walker. There are several good editorial articles, fewer trade notices than formerly, and the usual number of manufacturers' advertisements. Except for the latter, in fact, the contents of the Journal appeal this time rather to members of the Association themselves than to their prospective customers abroad, to whom the first issues of the Journal were primarily dedicated.

ADVERTISING WINDOW SIGNS

THE illustration is of a window sign designed and made by Simplex Conduits, Limited, for the new showroom of the Glasgow Corporation Electricity Department, the opening of which was a public function in Glasgow last week. During the present trying times for shopkeepers, when the lighting restric-



tions in large towns are strictly enforced, it is useful to remember that windows lighted in this way are well illuminated, without flooding the street with light, or half blinding the observer.

It is curious that it should have taken a European war to impress correct window lighting—as many other things—upon us, but now it has been done there should be good business in such signs.

CATALOGUES, PAMPHLETS, &c., RECEIVED

EDISWAN RADIATOR LAMPS.—A leaflet from the Edison & Swan United Electric Light Co., Ltd. (Ponder's End, Middlesex), deals briefly with radiator lamps. Attention is drawn opportunely to the special flange cap which assures rigidity.

EDISWAN LAMPHOLDERS.—The Edison & Swan United Electric Light Co., Ltd. (Ponder's End, Middlesex), has sent us a card giving information regarding Ediswan lampholders.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Bo'ness.—The National Electric Construction Co. is to instal temporarily two 100-k.w. Diesel oil engines. These, together with the other necessary extensions of switchgear, buildings, &c., are estimated to cost between £6,000 and £7,000.

Cape Town.—One 4,000-k.v.a. steam turbo-alternator with condensing plant (or a unit of smaller or larger capacity provided that better delivery date is offered), and a 1,000-k.w. condensing plant. Consulting Engineer, H. D. Wilkinson, 4 Queen Street Place, E.C.

Chesterfield.—The L.G.B. has sanctioned a loan of £5,000 for new generating plant.

Pembroke.—A new Diesel engine and generator is to be installed at an estimated cost of £2,000.

Rathmines.—The Electricity Department requires a motor-generator. Borough Electrical Engineer. October 28th.



Wolverhampton.—A loan of £5,000 is to be applied for in connection with mains to supply firms engaged on Government work.

Wiring

Lanark.—Electric lighting of Hairmyres Colony. Consulting Engineer, W. Arnot, 163 Hope Street, Glasgow. November 1st.

London: L.C.C.—Thornfield Elementary School, Hammersmith, 240 lighting points. November 3rd. (See an advertisement on another page.)

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Blackburn.—Cinematograph theatre, Darwen Street.

Bradford.—Smallpox hospital (£16,000). The sanction of the L.G.B. has been obtained.

Miscellaneous

Glasgow.—The Parish Council and District Board of Control requires a twelve months' supply of electric lamps and fittings for their hospitals, asylums, &c. Clerk, 266 George Street. October 25th.

Ireland.—Twelve months' supply of electrical fittings, lamps, cable, wire, and arc lamp carbons for Great Northern Railway Co. Secretary, Amiens Street, Dublin. November 4th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Berehaven.—The report and tender of Mr. P. H. Nugent, Electrical Engineer to the Rural District Council, upon the proposed electric lighting scheme, estimates that the capital cost will be about £1,500, and the annual cost about £75, not including maintenance of staff and plant. Mr. Nugent has undertaken to erect all the plant, &c., required, and the Council has accepted the offer.

Gillingham.—The Corporation has received a letter from the Anglo-American Oil Co., stating that the price of fuel oil for their Diesel engines was £5 2s. 6d. ex-Purfleet, or £5 13s. 9d. delivered at the electricity works. The Company intimated its willingness to fix up a contract for six or twelve months at these prices. The Board of Trade is to be asked for advice on the matter.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. Geo. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £87 10s. to £88 10s. (last week the same).

Liquidations.—A meeting of the British Drawn Wire Lamp Co. will be held at 59 Chancery Lane, W.C., on November 13th, at 11 a.m., to hear the Liquidator's account of the winding-up.

A meeting of creditors of Venner's Electrical Cooking and Heating Appliances, Ltd., will be held at Blomfield House, London Wall, E.C., on Tuesday, October 26th, at 12.30, to ascertain the wishes of the creditors as to the appointment of a joint liquidator.

Agencies.—A French dealer in accessories of all kinds for electric lighting, says the *Board of Trade Journal*, has considerable difficulty in meeting orders owing to shortage of local supplies, and desires to communicate with United Kingdom manufacturers.—An agent in Lyons wishes to represent United Kingdom manufacturers of electrical apparatus. Further particulars at 73 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

The many friends of Mr. A. V. Gifkins, the well-known electrical engineer, of 68 Victoria Street, Westminster, and Bankipore, India, and late of Elstow Works, Bedford, will, we are sure, regret to hear that he was very severely injured

in the recent air raid. He is now in hospital in London, and is making slow but satisfactory progress. Needless to say, he will welcome any letters from old friends. They can be addressed to him at the office.

The late Second-Lieut. H. G. Byng, of the General Electric Co., who, it will be remembered, was killed whilst fighting in France on May 18th, has left estate valued £73,716.

Pte. F. H. Gooch, one of the leading members of Messrs. Drake & Gorham's wholesale staff, has, we regret to learn, just been killed in the trenches at Vermeilles, France. He joined the Cameron Highlanders on the outbreak of war, and was home on five days' leave in July.

An Assistant Manager is required for a telephone exchange in the East. (See an advertisement on another page.)

The Holmfirth Electricity Committee requires a Working Electrical Engineer at a salary of 45s. per week.

LOCAL NOTES

Ayr: *Electricity Profits.*—There was a net surplus of £1,248 for the year to March 31st, 1915, which has been placed to reserve fund, which now amounts to £5,351. The number of units sold was 82,822 less than in the previous twelve months, and the coal bill shows a decrease of £513 due to the use of very low grade fuel made possible by improved stoking apparatus installed last year.

Barnsley: *The Borough Electrical Engineer.*—At the last meeting of the Council a question was raised as to the salary (£450 per annum) of Lieut. A. E. Barker, the Borough Electrical Engineer. Alderman Wray observed that Mr. Barker could not serve two masters, and should not receive two salaries. An inquiry into the matter was promised.

Barrow-in-Furness: *Rapid Progress.*—Mr. H. R. Burnett, the Borough Electrical Engineer, in his report for the year to March 31st, 1915, stated that although large extensions of the plant and mains were only completed in 1914, the conclusion of an agreement in October last year with Messrs. Vickers for a supply to their naval construction works made it necessary to proceed at once with further large extensions to both plant and mains. These latter extensions comprise a 2,000-kw. B.T.-H. turbo-alternator with condensing plant, switchgear, &c., and a water-tube boiler capable of evaporating 30,000 lb. of water per hour supplied by the Stirling Boiler Co., together with economiser, &c. These extensions have cost £13,000 for plant and £8,000 for mains. With regard to the Hiring-Out Department, this has done useful work, but the effect would be greater if there was a showroom in a suitable position in the centre of the town. The total number of units sold for the year were 8,597,410, compared with 2,081,317 in the previous twelve months, an increase of 72 per cent. The net profit after meeting capital charges was £3,163, against £513 in 1913-14. The phenomenally large increase in output during the past year is again assured for the present twelve months, and this has precluded the necessity for an increase in charges.

Greenock: *Lecture on Accumulators.*—Mr. F. H. Whysall, the Borough Electrical Engineer, opened the session of the Greenock Electrical Society with a lecture on storage batteries. The lecturer emphasised the conclusions arrived at in his recent Paper to the Institution of Electrical Engineers, viz., that the use of storage batteries is a matter of increasing importance, and detailed their construction, at the same time calling attention to the latest improvements.

Heywood: *Bulk Supply.*—The work in connection with the provision of a bulk supply to the Corporation by the Bury Corporation is almost completed.

Hounslow: *Increased Charges.*—The Chairman of the Electricity Committee is in favour of increasing the charges for electricity by 10 per cent., but the Committee as a whole will not agree to this policy. He anticipated in consequence that there will in all probability be a deficit of £700 on the current year's working.

Kettering: *New Plant.*—A new generating set, supplied by the Brush Co., with Messrs. Siemens Bros. as contractors for the alternator, was started up last week. The cost of these extensions has been about £8,600.

Leigh (Lancs.): Proposed Showroom.—Dissatisfaction was expressed at the last meeting of the Corporation with a recommendation from the Electricity Committee that it is not desirable for the present to open any electrical showroom owing to the advanced prices of fittings. Councillor Dobb, Chairman of the Electricity Committee, however, explained that with the cost of fittings at its highest, it was scarcely

the time to embark on business of that sort. Nevertheless, the Council referred the matter back, several speakers expressing the opinion that it would be advantageous.

Manchester: *The Barton Scheme Still Opposed.*—The Manchester Ratepayers' Association has not yet abandoned its attempt to secure the postponement of the construction of the Barton power station. A letter has now been addressed to the President of the L.G.B., in which it is stated that the Corporation's affairs are managed under what is called a "system of government by committees nominated for the political parties." It is asserted that the Council itself has given practically no time to a consideration of the merits of the scheme.

Ross: *Increase of Maximum Charge.*—We referred on September 30th to the application of the Newquay Electric Light & Power Co. to the Board of Trade for an increase in the maximum charge in the Company's Provisional Order from 6d. to 8d. per unit. The Ross Electric Light & Power Co. has been successful in obtaining a similar increase, the Board of Trade having recently given its decision in favour of the Company.

West Bromwich: *New Plant.*—In order to enable the Electricity Department to meet the increasing demands from firms engaged on Government work, it has been decided to purchase a second-hand turbo-alternator set from Messrs. R. H. Longbotham & Co., of Wakefield. The cost is to be taken from the depreciation and reserve fund.

MISCELLANEOUS.

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SUMMARY

SOME interesting observations with regard to electrical trade with China were made, in an interview with our representative, by Mr. T. M. Ainscough, the Special Commissioner appointed by the Board of Trade to inquire into the conditions and prospects of British trade in that country (p. 434).

THE report of the Bradford City Electrical Engineer for the past year shows a very satisfactory state of affairs, the net profit being a record. The effect of the Treasury ban upon capital expenditure is shown, but a considerable number of extensions which were in hand early last year are being completed (p. 434).

SUCCESSFUL experiments with the use of 5,000 volts direct current for traction purposes are described (p. 435).

WE give particulars with regard to the arrangements for next session of some of the Institution Local Sections (p. 435).

STANDARDS for "flex" with galvanised iron instead of copper wires, and insulation of reclaimed rubber, have been issued officially in Germany (p. 435).

THE under-feed stokers put in for the extension at the Stepney electricity works, which was the subject of an article in our last issue, are more fully described (p. 436).

OUR Questions and Answers page this week deals with the ammeter and voltmeter equipment for a small factory installation for lighting and power (p. 437).

WE give an account of some recent successful experiments in long-distance wireless telephony (p. 437).

Two patent specifications relating to telephone relays were published last week. Subjects of others include

electric welding and ceiling roses. A patent for a cab-signalling system is opposed (p. 438).

AN interesting discussion on the lubrication of Diesel engines is reported (p. 438).

EXTENSIONS estimated to cost £30,000 are contemplated at Coventry; new plant is required at Rawtenstall; and mains at Plymouth, Poplar, and Salford.—Stores are required by the Dublin United Tramways Co. (p. 439).

THE Maidstone Corporation has been fortunate in being able to sell to the Government, for wireless telegraph purposes, three small generating sets which have been replaced by a Ljungstrom turbine.—There was a net profit of £10,397 at Greenock last year after providing £2,442 for depreciation.—Figures are given of the progress of the Liverpool electrical undertaking (p. 440).

AN interim dividend at the rate of 10 per cent. per annum is declared by Callender's Cable & Construction Co.—Dick, Kerr & Co. also had a good year in 1914-15, but no dividend is recommended.—Messrs. Ferranti similarly do not declare an ordinary dividend (p. 440).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDANT.

Drills, 6.15 to 7.15; 7.15 to 8.15.

(To-day) Thurs., Oct. 28th: Section III., technical. Section I., shooting.

Fri., Oct. 29th: Section IV., technical. Section II., squad or working party.

Mon., Nov. 1st: Section I., technical. Section IV., squad or working party.

Tues., Nov. 2nd: Section II., technical. Section III., shooting, or working party.

Thurs., Nov. 4th: Section III., technical. Section II., shooting, or working party.

Fri., Nov. 5th: Section IV., technical. Section I., squad or working party.

Sat., Nov. 6th: Company Parade, 2.30 p.m.

Sections for technical drill will fall in at the Headquarters of London Electrical Engineers (T.F.), 46 Regency Street, S.W.

Sections for squad, signalling, shooting, and working parties will fall in at the new Headquarters, Chester House, Eccleston Place, S.W.

All members who have not yet been measured for uniforms will attend at Headquarters on Friday, Nov. 5th, for this purpose.

All men who draw haversacks and water-bottles for week-ends working parties are requested to return them to Headquarters on the following Monday.

Members desiring to have their own haversacks and water-bottles can purchase them at Gamage's, price 2s. 6d. haversack, and 5s. 9d. water-bottle.

The following Corporals have been appointed: C. McArthur Butler, Section II.; H. J. Golding, Section III.; B. C. Garman, Section IV.; R. T. Morris, Section IV.; T. Spiers, Section III.; H. Jantzen, Section II.; E. A. Ullmann, Section I.; J. M. Smith (Temporary Corporal).

For "Arrangements for the Week" see p. 439.

ELECTRICAL TRADE WITH CHINA

Interview with the Special Commissioner

MR. T. M. AINSCOUGH, the Special Commissioner appointed by the Board of Trade to inquire into the conditions and prospects of British trade in China, has recently returned to London, and has been good enough to grant our representative an interview. There is, he told us, an enormous market all over that country for electric light and power plants and apparatus, telephones, &c. Up to the present this trade has principally been in the hands of the big German and American firms, but the prospects of increasing trade are so good that it should be well worth the while of British electrical firms either individually or in groups to give greater attention to the Celestial Empire. At present British electrical firms have got very little further than the treaty ports, and there should be plenty of work to be done and orders to be obtained from the interior.

The present course of events is somewhat as follows:—A small town, say, decides to have electric lighting, and about a dozen native tradesmen and officials form a company. They will then apply to the nearest foreign firm for assistance in carrying out the scheme. The German firms have branches in most of the treaty ports, and, what is of equal if not greater importance, correspondents in all parts of the country. Immediately they hear of such a proposal they will send a Chinese-speaking and trained engineer from the nearest treaty port, and he will be prepared, if necessary, to spend a year or more seeing the right people and entertaining them. If he finds that there is competition, as will probably be the case if the distance from the treaty port is not great, his firm will, on his advice, be content to take the profit chiefly out of the subsequent sale of accessories, &c., making an agreement that the business in these shall go to the firm putting in the plant. In such cases long credit is not necessary, and an arrangement would probably be made, say, for one-third of the payment to be made with order, and another third on the arrival of the plant.

Mr. Ainscough is strongly of opinion that the future lies with active penetration into the country. If the firms desiring the trade cannot themselves establish their own branches, a great deal may still be done through merchants already established in China, but it is useless to attempt this in a haphazard manner. A thoroughly organised system must be introduced, and their own engineers must be on the spot to assist and work with the merchants in question. Although a knowledge of Chinese is not essential in the treaty ports themselves, it is indispensable for penetration into the interior, as well as a knowledge of Chinese character and business methods and customs. Mr. Ainscough suggests that engineers before going out should learn Chinese here; this is possible either in London or Manchester, and, of course, at Oxford and Cambridge. After, say, twelve months—or even six months—of lessons here and an equal time of concentrated application to learning in China, an intelligent man should be able to manage fairly well in the language.

As regards general sale of accessories, &c., apart from large light and power schemes, &c., price is the governing factor, as the buyers there know little of quality; this is practically the same everywhere where German competition has to be met abroad.

To conclude, however, the main thing is proper organisation. It takes time to establish, and the commercial men of engineering firms who are less busy than their colleagues who are more closely concerned with manufacture might well start at once.

THE BRADFORD ELECTRICITY DEPARTMENT

A VERY interesting report has been issued by Mr. T. Roles, the Bradford City Electrical Engineer, upon the working of the Electricity Department for the past year. Considering the abnormal conditions, the results achieved cannot be regarded as other than satisfactory. Although the output has not grown to anything like the same extent as in a number of previous years, an increase of nearly three-quarters of a million units is recorded, the total number sold being 28,743,718. Only the tramways supply has shown a slight falling off. When considering these results it is worthy to note that up to the end of November, 1914, the number of units sold for all purposes was lower than in the corresponding period of 1913.

Special attention is drawn to the success attending the supply to domestic consumers who have adopted the rateable value

system of charging, the units taken by such consumers representing an increase of practically 30 per cent. on the figure for the preceding twelve months. Mr. Roles' paper on this subject in conjunction with Mr. A. S. Blackman, Borough Electrical Engineer at Sunderland, at the I.M.E.A. meeting this year, will still be fresh in our readers' memories. Of the total of 1,333 domestic consumers 807 are charged on the rateable value system, as compared with 633 in the previous year, and the average units used per consumer by this class is 988, against 970 in the previous year.

The net profit for the year is £18,956, and a factor which has contributed to this is the decision of the Finance and General Purposes Committee to adopt the principle of accumulating sinking funds in connection with various corporation undertakings. The effect of this decision has been to reduce the percentage which the sinking fund contribution for the year bears to the capital of the Department to a figure more comparable with those obtaining with the majority of the municipal electricity supply undertakings in the country. A sum of £5,000 has been allocated to relief of rates, £6,910 has been expended on capital works, £114 applied to the depreciation of meters purchased from stock, and the balance of £9,437 has been transferred to the depreciation and renewals account.

Discussing the extension of the plant, Mr. Roles relates how during the early months of the war municipalities were urged to put in hand at once all extension schemes possible with a view to providing employment, whilst early this year, it having been found there was, if anything, a lack of labour rather than employment, and also for other well-known reasons, the Treasury decided to limit as much as possible the borrowings of local municipalities. For this reason the provisional sanction which had been given early in 1914 for a loan of £91,250 to extend the Valley Road works was reduced to £79,683, and an application in October last for £52,000 for mains, transformer chambers, &c., was finally reduced to £14,000. In July this year, the L.G.B. was asked to sanction a loan of £20,000 in connection with war work, but even here sanction was only given to the cost of the mains, &c., regarding which definite information could be given. Since then special application is made in respect of every case as it arises.

Considerable delays have naturally been experienced in completing the extensions at the Valley Road works, and it was extremely fortunate that the contracts were placed and well in hand before the Government found it necessary to exercise a complete control over the outputs of engineering establishments in the country, otherwise it is doubtful whether much of the plant would have been ready in time to assist in coping with this winter's load. The induced draught plant was completed and put into operation in October, the second cooling tower was put into commission in May, and the storage battery, regulating boosters, and switchgear were placed in regular service on July 5th. By the aid of this apparatus the boilers and generating sets can now be operated more economically by being kept loaded up to much nearer their full rated capacities for longer periods during the day than formerly, and a much more uniform steam pressure can be maintained, thus allowing sudden demands to be made with safety and certainty. The work in connection with the installation of the 5,000-kw. turbo-alternator is so far completed that preliminary trials have been made, and it is hoped that the various small details remaining to be finished will be dealt with in time to allow of the set being officially started up during the next few days. Similar remarks apply to the two 1,500-kw. rotary converters.

As a result of experiments made during the year, it has been found possible to run the sub-stations in parallel with the Valley Road power house on the D.C. as well as the A.C. side, and the plant is now regularly operated in this manner. Greater economy in running is thus obtained, due to improvement in the load factors of the generating sets, immediate additions to the converting plant in the sub-stations have been rendered unnecessary, and the supply to the various tramway routes dealt with from these sub-stations has been considerably improved.

After a reference to the successful work of the Publicity Department, whose activities at the moment, however, have been considerably curtailed owing to the holding up of further loans, Mr. Roles deals with the future prospects of the undertaking. Although the new connections obtained during the past twelve months will undoubtedly lead to the output of the present financial year being considerably in excess of the figure recorded in any previous year, it is not expected that the financial result will compare so favourably as the one now announced, owing to the higher works costs due to advances in the prices of coal and materials, wages, and allowances to dependents of employees serving with the Forces. Heavier capital charges will also have to be borne, on account of the new plant and mains, and to some extent owing to the high rate of interest which has now to be paid on loans. The rates will also be higher, not only on account of the increase in the amount, but also by reason of the assessment having been advanced. At the same time considerable economies should be effected by the new plant and, taken generally, the Committee are able to look forward with confidence to the future of the Department.

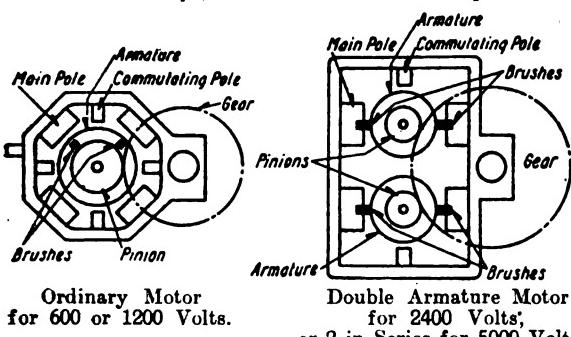
5,000 VOLT DIRECT CURRENT FOR TRACTION

THE use of very high pressure direct current for traction purposes has in the past been considered impracticable for many obvious reasons. That the difficulties are now, however, gradually being solved is shown by the fact that an installation of this type has recently been put into successful operation in Michigan, U.S.A. The equipment has been designed and manufactured by the Westinghouse Electric & Manufacturing Co., of Pittsburg, and is considered to be of an experimental nature, although it has been in commercial operation for about three months, and has so far proved entirely successful.

The features of the new system, which is described in the *Electric Railway Journal*, are briefly as follows:—

The power, which is supplied to the car at 5,000 volts through overhead wires, is obtained from three mercury-arc rectifiers, which receive power from a 60-cycle, three-phase system and are operated in series. Each car is provided with four 2,400-volt motors connected two in series, each motor having two bi-polar armatures in series driving the same gear wheel. A remarkable feature of the system is that the armatures can be arranged in parallel groups, so that the car will run on a 600-volt supply system in the vicinity of the town, and it can be changed over to operate at 5,000 volts on long-distance tracks.

The greatest difficulty to be overcome in providing an equipment of this kind is, of course, the design of the motors for such high voltages when space is so limited. In order to secure the maximum benefits from electrification, a railway must be able to run not only locomotives, but multiple-unit car service. Consequently, any system of electrification that hopes for recognition for heavy traction purposes must be suitable for operation on passenger cars. It is not so difficult in the case of electric locomotives to secure space for the necessary number of commutator bars and for the requisite creepage surface for insulation purposes, but it has been a serious problem to secure these requisites for a



5,000-VOLT D.C. EQUIPMENT—COMPARISON OF STANDARD MOTOR AND 5,000-VOLT MOTOR.

motor of the size required for ordinary passenger cars without exceeding the commercial limits in weight, cost, and dimensions.

The illustration which we have reproduced shows the manner in which the difficulties in the design of the motor have been overcome. A motor of this type, it may be said, is now on exhibition at the Panama-Pacific Exposition. It is known as the twin-armature bi-polar type, and it has many advantageous features for high-voltage work. A two-pole design permits the use of double the voltage on a given commutator that is possible with a four-pole motor, on account of the greater distance between the brushes. The twin armatures make the weight but little more than that of a corresponding four-pole motor. Fewer field coils are required than are used with the four-pole motor, and the two armatures, being geared to the same axle, act as one unit, and cut the pressure on the gear-teeth in half. The two armatures are connected in series, and consequently the voltage on each is reduced to lower limits. The form of the motor lends itself readily to a very effective type of insulation, and the mechanical construction is simple and strong.

The commutation is said to be sparkless, and there is absolute freedom from flashing over. Large creepage surfaces are supplied, both on armatures and brush-holders, in order to give immunity from earths. One characteristic that is incidentally favourable to the design is the fact that the current is small, being only 30 amps. for each 100-h.p. motor, and therefore only a few small brushes are required. Thus with the excellent commutation there is very little wear either on brushes or commutators—a very fortunate circumstance, as this means that the amount of carbon and copper

dust originating in the motor, and consequent risk of insulation failure, is small. It is fully recognised that upon the permanence of the insulation depends the success or failure of the motor, and this is something that time alone can determine.

Next to the motors, the control is perhaps the most important feature of the equipment, since the switches must close and open the high-voltage circuits properly, and must be insulated to stand continuously the maximum voltage to earth. In order to secure a relatively large number of breaks in series, each switch is made with two breaks in series. In construction the switches are very similar to the standard Westinghouse electro-pneumatic type. The starting resistances are of the ordinary grid pattern, with, of course, special insulation.

The auxiliary equipment for providing current for control and lights, and the air-compressor motor are operated at 150 volts supplied from a storage battery. This battery is placed in the main motor circuit between the motors and the rail. The auxiliary motors take less than 3 per cent. of the total power taken by the car.

The tests, which are being made on a line of twelve miles in length on the Michigan United Traction Co.'s system, have not yet continued long enough to enable one to draw conclusions as to the ultimate success of the use of 5,000-volt direct current for traction purposes. All that can be stated at the present time is that the tests have so far proved extremely satisfactory, and the fact that so many difficulties have already been overcome gives ground for hope that the system will be a commercial possibility of the future.

THE INSTITUTION LOCAL SECTION ARRANGEMENTS

THE Local Sections of the Institution of Electrical Engineers are proceeding very much on ordinary lines with regard to their meetings during the forthcoming session.

As we have already announced the opening meeting of the Birmingham Section was held on Wednesday last, when Col. J. F. Lister, the Chairman, delivered his Inaugural Address. So far Papers have been arranged for the next two meetings, viz., Nov. 24th, when Prof. A. B. Field will deal with "Difficulties of Design of High-Speed Generators"; whilst on Dec. 15th the Paper will be by Mr. J. D. Morgan, the Hon. Secretary, on "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks."

The programme of the meetings of the Yorkshire Section for the first half-year of the session is as follows:—Nov. 10th, Chairman's Address and Smoking Concert. On Dec. 8th Prof. A. B. Field will give his Paper on "Difficulties of Design of High-Speed Generators," and on Jan. 12th, 1916, Mr. J. R. Beard will deal with "The Design of High Pressure Distribution Systems."

The provisional programme for the Scottish Section has also been prepared. On Dec. 9th Mr. D. A. Starr, the Chairman, will give his Inaugural Address in Glasgow; the meeting on Dec. 14th will be in Edinburgh, when Mr. G. Wilkinson will read a Paper on "Electric Heating: Its Present Position and Future Development"; on Jan. 11th, in Glasgow, Prof. Magnus Maclean and Mr. D. J. M'Kellar will give part two of their Paper, "Distribution and Rise of Temperature in Field Coils." Meetings have been arranged for Feb. 8th in Edinburgh, March 14th in Glasgow, for which Papers will be announced in due course, and on April 11th the annual general meeting will be held in Glasgow.

The Chairman of the Newcastle Section, Mr. P. V. Hunter, will give his inaugural address on Monday, November 8th.

GERMANY USES IRON WIRE FOR "FLEX"

THE scarcity and high price of copper in Germany has reached such a point that "flex" is now to be made with iron wire instead of copper. In an official communication by the Verband Deutscher Elektrotechniker, published in the *Elektrotechnische Zeitschrift* of September 30th, standards are laid down for this material, it being mentioned in passing that zinc wire is unsuitable for it.

The wires are to be of galvanised iron, and two standard sections, 2·5 and 4 sq. mm., are fixed, equivalent to solid wires of about 15 and 18 S.W.G. respectively. The individual wires must not exceed 0·3 mm. diameter (about 31 S.W.G.). Vulcanised rubber 1 mm. radial thickness is employed for the insulation, and this may be made of reclaimed rubber. Samples have, however, to withstand a pressure test of 2,000 volts A.C. after 24 hours' immersion in water.

Standards for iron workshop flex have also been issued, with sections up to 16 sq. mm.

THE UNDERFEED STOKERS AT STEPNEY ELECTRICITY WORKS

WE referred last week to the extensions at the Limehouse electricity works of the Stepney Borough Council, involving an increase of 10,000 kw. in the capacity of the station. The underfeed stokers and the Prat "in-circuit" draught system are among the distinctive features, and we

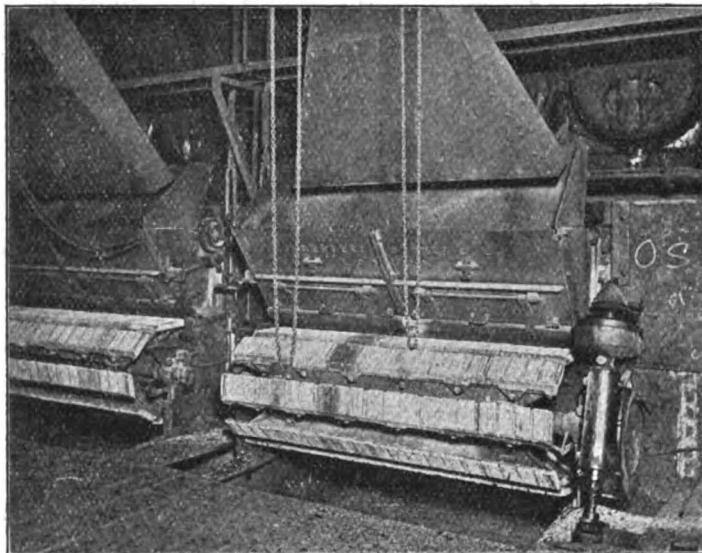


FIG. 1.—FRONT OF ONE OF THE FURNACES.

are able to supplement our description with some further particulars of these.

There are four Howden boilers, each having a heating surface of 6,700 sq. ft., designed to evaporate, normally, 36,000 and maximum 45,000 lb. of water per hour at a steam pressure of 200 lb. per sq. in., with a superheat of 200° F. Each of the four boilers is fitted with a pair of Underfeed travelling grate stokers, the width of each grate being 7 ft. 4 in., and the effective length 13 ft. 1½ in., giving a grate area per boiler of 192 sq. ft. The coal burnt normally per boiler upon each pair of stokers is 5,600 lb., and for the maximum overload duty 7,000 lb. The above evaporation are obtained with slack coal having a heating value, as fired, of 10,000 B.Th.U.'s.

The stokers are driven by shafting and reduction gear, which reduces the speed from 900 r.p.m. on the motor spindle to 70 r.p.m. on the stoker shaft. Each boiler is fitted with an "Usco" air heater having 54 elements and a heating surface of 3,132 sq. ft. The heaters are capable of raising the air 150° F. when the gases passing through the heater are at a temperature of 600° F.

Balanced draught is employed, the forced draught supplying the air to the grate under pressure, and the gases being drawn from the furnace by the Prat "in-circuit" system, capable of setting up at the base of the chimney ¼ in. w.g. at normal rating, and ½ in. for maximum rating. A Prat chimney, 79 ft. high from the crown to the floor-level and of 5 ft. 7 in. diameter, is mounted upon each air heater. The fan requires 10 h.p. under normal conditions, and 14·5 h.p. overload, and runs at a normal speed of 525 r.p.m. and a maximum speed of 675 r.p.m. Each induced-draught fan is driven by a direct-connected motor. The power absorbed by both forced and induced draught fan for each boiler at normal load is 28 b.h.p.

The forced draught for each boiler is obtained from a double inlet steel plate fan capable of delivering 28,160 cu. ft. of air per minute at a pressure of 2½ in. w.g. The fan runs normally at a speed of 590 r.p.m., and it can be varied by means of speed regulation on the driving motor from 525 to 650 r.p.m. The h.p. absorbed by the fan when supplying air to one boiler at normal rating is 18 h.p., but the forced-draught fan and motor plant are designed so as to provide air for two boilers if necessary.

The ashes from the furnaces are dumped at the back and removed from the basement below the boiler-house floor. In this basement is situated the main air trunk from which the

air is taken to the wind-boxes of each stoker, and also the driving shaft by means of which these stokers are driven.

The forced and induced draught equipment is all installed above the boilers. The gases leave at the front of each boiler, and are conveyed through uptakes to the heater chambers and thence through the heaters to the base of the Prat chimney. The platform immediately above the boiler, and approximately on a level with the heater chambers, carries the forced-draught fan and motor, and a second platform erected above this carries the induced-draught fan and motor. Both motors are mounted on common base-plates with the bearings of the fans which they drive. The forced-draught fan forces the air through the connecting trunk to the inlet of the heater, the outlet of which is connected by means of the vertical trunking with the duct in front of the stokers.

The motors are of the pipe-ventilated type.

With the exception of the air duct and driving shaft, each boiler constitutes a separate unit.

For those of our readers who are not intimate with the system of the Underfeed stoker, we add the following brief description:—The stoker consists of an endless moving grate of box-shaped fire-bars mounted upon chains, the links of which are rotated by sprocket wheels. The tops of the fire-bars are slotted for the delivery of air into the fuel. This air enters through rectangular boxes D (Fig. 2) at the side of the stoker, and flows into longitudinal chambers E. The upper surfaces of the latter are sloping at an angle of about 30 deg., and provided with longitudinal openings A running the whole length of the grate, which deliver the air into the open ends of the fire-bars. The supply of air is controlled by the adjustment of hinged dampers A, which are triangular in shape. The fuel is delivered into a feeding hopper (seen in Fig. 1) in the ordinary manner, and the quantity fed upon the grate is regulated by a sliding shutter worked by a rack and pinion motion; two doors (also seen in Fig. 1) enable the condition of the grate to be observed, and also permit of hand-firing if necessary.

The whole arrangement is well-designed, and it seems probable that extremely interesting figures as to the per-

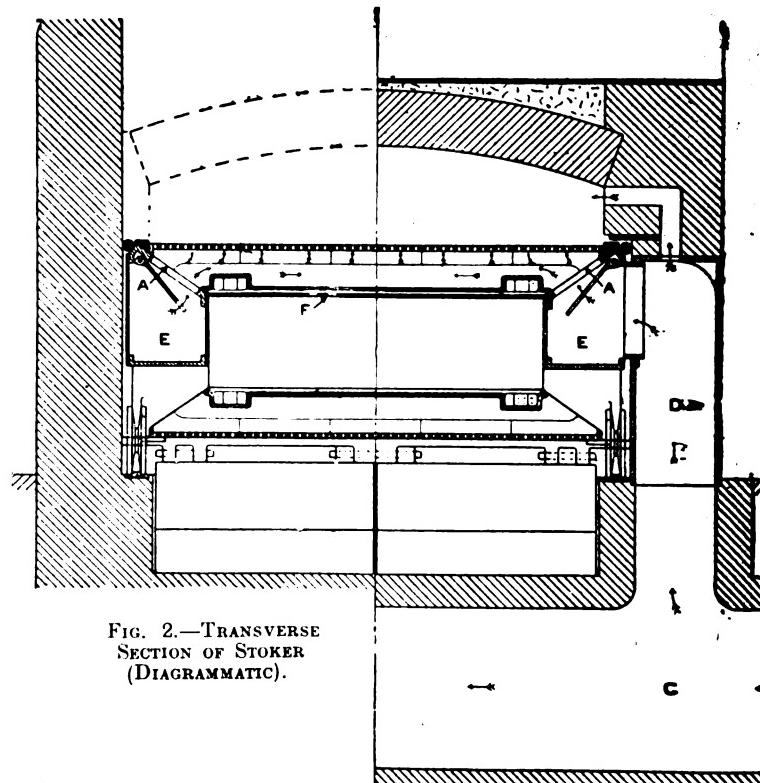


FIG. 2.—TRANSVERSE SECTION OF STOKER (DIAGRAMMATIC).

formance of these boilers may be obtained. This combination of the Underfeed stoker with the Prat draught system is certainly well worth close attention of central station engineers.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and be, for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,464.

It is desired to make up an adjustable resistance for occasional testing purposes in a small works, to give a voltage drop of 100 with a current of 5 amps. Describe a cheap method of doing this; state the material used, and the approximate cost of the resistance.

(Replies must be received not later than first post, Thursday, Nov. 4th.)

ANSWERS TO No. 1,464.

A three-phase supply of about 50 kw., chiefly for power purposes (induction motors), is taken through a static transformer, the primary pressure being 2,000 volts, and the secondary 200 volts. Discuss how many ammeters and voltmeters are absolutely necessary and how many desirable.

The first award (10s.) is given to "W. H." for the following reply:

As the installation is only a small one, an expensive or elaborate equipment is out of the question, and the instruments which may be considered as absolutely necessary for safety in working would be as follows:

Ammeter, A_1 , scaled to read 0-250 amps., connected in the secondary circuit in one line only, and preferably working off a current transformer.

Voltmeter, V_1 , scaled to read up to 250 volts, and connected across the secondary of the transformer at the bus-bars (or at the transformer terminals if no bus-bars are used).

Voltmeter, V_2 , scaled to read 2,500 volts, and connected to a single-phase potential transformer, the primary of the latter being connected across two poles of the outgoing side of the main oil switch.

This instrument V_2 is not absolutely necessary, but enables the operator to see at a glance whether the 2,000-volt supply is on the mains by simply closing the main oil switch feeding the 50-kw. transformer.

The ammeter A_1 enables the operator to check the total current on the secondary side of the transformer, while the voltmeter V_1 is necessary to see that the secondary is live and at the correct voltage, thus indicating with moderate certainty that the transformer is undamaged.

In order, however, to check the various motor circuits, and also to make certain that no unbalancing faults have occurred, the following additional ammeters and voltmeters are desirable:

Ammeter, A_2 , in one line of each motor circuit.

Voltmeter, V_1 , modified by the addition of a switch and connections to enable the operator to check the voltages on all phases.

Voltmeter, V_2 , modified by the addition of a switch and the substitution of three-phase potential transformer to read all three phases. This is really a refinement which may or may not be desirable, depending on the class of the installation.

Ammeter, A_3 , connected through current transformers on the H.T. side, and scaled to read 0-30 amps.

In this case, as the oil switch will probably have trip coils for operating in two phases, A_3 could be placed in series with them, and at a little extra cost a change-over switch could be installed enabling the current in each of the three lines to be read off.

The second award (5s.) is made to "E. B. P." for the following reply:

The absolutely essential ammeters and voltmeters in an installation such as the one under discussion may be put down as none at all, since the supply can be given quite well without them. However, in order to be able to note what, if any, fluctuations take place in the load, one ammeter may be regarded as essential; this instrument may be worked off the same current transformers that supply the watt-hour-meter, and provided with switches to allow of it being connected to any phase. If the watt-hour-meter is on the H.T. side, it will probably have only two current transformers, but in this case the overload relay will require three transformers, so that the current in the third phase can be measured by the ammeter without any difficulty. If the watt-hour-meter is on the L.T. side, it will most likely be a four-wire instrument, requiring a current transformer in each phase, to which the ammeter may be connected.

In considering the number of ammeters and voltmeters actually desirable, we must consider what measurements should be made. On the low-tension side we should be able to read the current in each phase, and also, perhaps, in the neutral wire; the volts between phases and the volts between each phase and the neutral. An ammeter should be installed in each phase of the low-tension side, and may be worked by current transformers or by the main current, as may be most convenient in the particular case. If a neutral ammeter be fitted up, it may have the neutral leads connected directly to it without a transformer, as the neutral wire will not be a very large one on an installation of this size. One voltmeter may be used, capable of being connected between any two phases or between any phase and the neutral by means of plugs or switches. On the H.T. side it may be considered desirable to have an ammeter capable of being connected to current transformers in each phase by means of suitable switches, or three ammeters may be used. If the load is very fluctuating, and if it is not intended to take and record frequent readings, the L.T. instruments should be of the recording type, so that any abnormality in the working of the electrical plant can be noted at any time.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

Some remarkable successes have been attained from the recent experiments in wireless telephony in America, of which we gave some account last week. Telephone communication has now been achieved between Washington and the following points:—Panama Canal, 2,100 miles; San Diego, Cal., 2,300 miles; San Francisco, 2,500 miles; and Honolulu, Hawaii, 4,900 miles. It is interesting to note that this last communication had to traverse the whole continent of North America, going over land for a distance of 2,500 miles. The significance of this is that it is much more difficult to send wireless signals of any kind over land than over water. The fact that none of the towers involved in these tests, except that at Panama, might be considered as having antennæ of extraordinary power is further significant of the achievement. The tower at Honolulu, on which signals were received over a distance of 4,900 miles, is quite a small one, the equipment consisting of a span of wires about 250 ft. long, connecting the top of a smoke-stack 100 ft. high with the top of a water-tank about 80 ft. high.

The experiments have been conducted by the American Telephone & Telegraph Co. and the Western Electric Co., the wireless station of the U.S. Navy Department at Arlington, Virginia, having been lent to them for this purpose. It is said that wireless telephone messages have been received at the Eiffel Tower from this station. An interesting feature of the experiments is that it has been found possible by automatic apparatus to transfer messages from wires to wireless, and back again to wires. Standard office telephone instruments are stated to be suitable for sending and receiving, but technical details of the system are being withheld on account of a complicated patent situation.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 21st, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

20,176/14. **Electric Welding.** O. C. KNIFE and R. H. READ. A method of welding sheets, &c., consisting in bringing the parts to be united into contact, and applying a current by means of annular electrodes, in the centre of which an unconfined gaseous space is provided to equalise the heat. (Six figures.)

20,238/14. **Telephone Relay.** F. SCHIESSLER. The intensification of the weak undulating currents is effected by varying the conductivity of a medium placed between electrodes or preferably between condenser plates interposed in an intensifying circuit and the solid, liquid, or gaseous dielectric of which is ionised so that the ions form carriers of the intensified current. The displacement current produced by the superposition of the current to be intensified at the condenser producing an undulating current of higher intensity. (Six figures.)

20,920/14. **Ceiling Rose.** W. WILLIAMS, E. WARBRICK, and THE ANCHOR CABLE Co., LTD. A form of ceiling rose, the body of which forms a sealing chamber where the terminals can be covered with compound. (Ten figures.)

22,937/14. **Telephone Relays.** A. H. OLSSON and H. B. M. PLEIJEL. A telephone repeater with two induction coils so combined that one is best adapted for working with the speaking current and the other for working with the calling current. The latter is bridged by a capacity which acts as a high resistance to the calling currents, but transmits the speaking current without difficulty. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables, Insulating Materials, &c.: SHARP [Dielectric composition] 4,820/15.

Switchgear, Fuses, and Fittings: WILKINSON [Thermal switches] 23,775/14; TUCKER and CRABTREE [Switch covers] 2,968/15.

DIESEL ENGINE USERS' ASSOCIATION

At the October meeting of the Diesel Engine Users' Association, held at the Institution of Electrical Engineers, progress was reported with the scheme for insurance at Lloyds against breakdown of Diesel engines, and in connection with the Association's efforts to obtain better terms from the Inland Revenue authorities for a reduction in regard to depreciation on the assessment of Diesel engine plant for Income Tax.

The discussion on the question of "Lubrication of Diesel Engines" was then resumed. Mr. C. O. Milton (Borough Electrical Engineer, Maidenhead), observed that a careful consideration of the results obtained on various plants seemed to show that the consumption of lubricating oil on any particular engine was practically independent of the load at which it worked. He admitted that the consumption of lubricating oil must necessarily be somewhat higher when the engine was working on a heavier load, and consequently at a higher temperature, but his point was that the lubrication arrangements had to be generally set slightly on the liberal side, so as to suffice for such times as the engine might be called upon to do a heavy load, and that the increase in consumption of oil at the heavier load was comparatively negligible. He therefore arrived at the conclusion that a reasonable basis for comparison in the consumption of lubricating oil on various Diesel engine plants might be obtained by working this out in figures of gallons, or thousands of gallons, per B.H.P. per hour, taking for this purpose the maximum B.H.P. of which an engine is capable. Tests on the consumption of lubricating oil, to be of any value, must necessarily be taken over a long period of actual working, and in this connection he referred to the great importance of adopting the best means of filtering or treating the oil recovered for re-use. Mr. P. H.

Telegraphy and Telephony: SIEMENS & HALSKE A.G. [Telephone installations] 18,239/14; MUSSO [Transmission over circuits of high capacity] 18,242 and 18,243/14; RELAY AUTOMATIC TELEPHONE Co. and AITKEN [Manual and semi-automatic telephone systems] 20,453/14; MCGAURAN [Call recorders] 22,906/14; BULLERS, LTD., and DAGNALL [Joints for metal telegraph posts] 23,761/14; MARTIN (Turner) [Telephone apparatus] 2,148/15; TIGERSTEDT [Microphone] 5,174/15.

Traction: B.T.-H. Co. (G.E. Co., U.S.A.) [Catenary line suspension] 20,557/14.

Miscellaneous: B.T.-H. Co. (G.E. Co., U.S.A.) [Vacuum discharge devices] 15,788/14; J. A. SINCLAIR & Co. and SNELL [Magnetic compasses] 2,750/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Ignition: STANDARD Co. [Electrodes] 13,754/15; VAN DEVENTER [Ignition apparatus] 13,815/15.

Instruments and Meters: AUBERT [Meters] 13,869/15.

Switchgear: DEY [Controllers] 12,810/15.

Opposition to Grant of Patent

Opposition has been entered to a grant on the following specification:—

18,443/14. **Cab Signalling.** H. A. THOMPSON. An induction system of signalling with moving trains.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, and TRANSFORMERS: SIEMENS BROS.' DYNAMO WORKS, LTD. [Control of motors in conjunction with flywheel converters] 15,231/06.

Switchgear, Fuses, and Fittings: M. G. DIAZ and A. YGRÉSILLON [Current limiter] 14,259/08.

Telegraphy and Telephony: T. T. BAKER [Facsimile telegraph] 15,918/09.

Traction: H. PIEPER [Petrol-electric vehicles] 15,178 and 15,180/06.

Miscellaneous: J. W. GILLIE [Magnetic compasses] 15,492/07; O. A. MYGATT [Ribbed glassware] 17,440/08; K. MAXAKER [Motor-driven centrifugal fan] 15,659/08; G. SAHMER [Electric lock] 15,991/09.

Smith considered that the low lubricating costs which had been arrived at on certain Diesel engine installations were to be attributed chiefly to the adoption of good methods of treating the oil. Mr. R. W. Lyle (The Hoffmann Manufacturing Company) was of opinion that the filtered oil should be allowed to stand for some considerable time before being taken for re-use, and that as a rule about 10 per cent. of new oil should be added to vivify it. The necessity of keeping a good body in the oil was of importance to prevent undue wear and tear on the bearings. He gave further useful information on several other points, and discussed the varying practice on different installations in connection with the removal of the carbon deposit from the top of the piston and from the rings as affecting the question of efficient lubrication of the cylinder. Mr. G. Porter (Borough Electrical Engineer, Worthing) gave figures of comparative tests which he had carried out on new oil and on oil after use in his Diesel engines, filtered or treated, which showed that the deterioration in its quality after a considerable amount of use was not very appreciable.

In the further discussion which followed it was generally agreed that the feeding of the lubricating oil to a Diesel engine could not in practice be regulated in accordance with the variations in load. Mr. C. Gould (Letchworth) stated that he found the consumption or destruction of oil increased considerably after the engine had been running for a long continuous period. Mr. H. L. Dixon (Leatherhead and District Electricity Supply Co.), said his experience was that the worn condition of liners resulted in a very definite increase in the consumption of lubricating oil, as well as in that of the fuel oil.

The next meeting of the Association will be held on Nov. 24th, when the subject of "Cracked Pistons" is to be discussed.

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.



Made in
all sizes of
Ordinary & Stout
Substances
to suit varying
Voltages.

BEST QUALITY
INDIA-RUBBER.

Prices on Application.

Manufacturers—

J. C. INGRAM & SON, Hackney Wick, LONDON, N.E.

CRYSELCO

THE ALL-BRITISH
ELECTRIC LAMP



BRITISH MADE BY
BRITISH LABOUR IN A
BRITISH FACTORY WITH
BRITISH CAPITAL



PATENT LOUD SPEAKING TELEPHONES

COMPLETE INSTALLATIONS FOR

WARSHIPS, MERCANTILE VESSELS,
MINES, POWER STATIONS, ETC.

Adopted by the British Admiralty, Foreign Governments,
the Leading Shipping Companies, and as used in many
Electrical Generating Stations.

ALFRED GRAHAM & CO.,
ELECTRICAL ENGINEERS AND CONTRACTORS,
ST. ANDREW'S WORKS, CROFTON PARK, LONDON.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Coventry.—Notwithstanding the recent large extensions which have been put in hand by arrangement with the Ministry of Munitions, the increasing demands of firms engaged on war work render it necessary for further plant to be installed at an estimated cost of £30,000. The matter is to be discussed with the Ministry of Munitions.

Darlington.—The installation of a 3,000-kw. turbo-alternator is contemplated.

London: *Poplar.*—The Finance Committee of the L.C.C. recommends sanction to a loan of £8,688 for mains. Expenditure under the sanction is to be limited, during the war, to purposes for the furtherance of the war.

New Zealand.—The Napier Council contemplates extensions at its power-house at an estimated cost of £18,000.

Plymouth.—A number of mains extensions are to be carried out.

Rawtenstall.—The Electricity Committee do not seem disposed to adopt the view that all new consumers, except those engaged on war work, should be refused during the period of the war, and the question of increasing the generating plant is under consideration.

Salford.—Additional feeder cable for Trafford Road sub-station (£226); other services, Blackburn Street district (£900).

Miscellaneous

Dublin.—The Dublin United Tramways require a twelve months' supply of electrical accessories. Chairman. November 15th.

Grimsby.—House-service boxes, fuse-boxes, and fittings. Deputy Borough Electrical Engineer. November 4th. (See an advertisement on another page.)

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London: *L.C.C.*—The tender of W. T. Henley's Telegraph Works Co. at £114 has been accepted for a main in connection with the lighting of refuges on the Victoria Embankment. Callender's Cable Co. tendered at £115 10s.; British Insulated & Helsby Cables at £117 10s.; and W. T. Glover & Co. at £117 15s.

The tender of Electromotors, Ltd., at £105 has been accepted for a motor in connection with the testing of electricity meters. The General Electric Co. tendered at £101 10s., or alternatively £139 10s.; and Variety's, Ltd., at £144 2s.

Hammersmith.—The existing contract between the Council and the British Electric Transformer Co. is to be extended to cover the supply for a period of three months of seven transformers of 50, 100, and 200 kw. capacity. The price is to be 7½ per cent. above the existing contract.

In order to maintain the full pressure in the Hythe Road area, 1,350 yards of new cable is to be laid. The tender of Messrs. Callender's Cable & Construction Co. at £1,312 has been accepted. There were seven other tenders varying in price from £1,285 to £1,400.

Newport (Mon.).—Ten tenders were received for the supply of converting plant, and that of the British Thomson-Houston Co. for a 264-kw. plant at £1,173 has been accepted.

Salford.—The tender of W. Geipel & Co. has been accepted at £130 15s. for 20,000 pairs of flame arc lamp carbons.

Arrangements for the Week.—*Friday, Oct. 29th.* University College. Lecture I., "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S. 5 p.m.

Junior Institution of Engineers, 39 Victoria Street, S.W. "Electric Clocks," by W. B. Prince. 8 p.m.

Saturday, Oct. 30th. Association of Mining Electrical Engineers, Notts. and Derbyshire Branch. University College, Nottingham. Election of officers for session. Paper to be read: "The Use and Abuse of Oils on Mining Plant," by T. C. Thompson. 3.30 p.m.

Tuesday, Nov. 2nd. Institution of Civil Engineers. Presidential Address by Mr. Alexander Ross. 8 p.m.

Association of Supervising Engineers. St. Bride's Institute, Ludgate Circus, E.C. "Accumulators," by R. Rankin. 8 p.m.

APPOINTMENTS AND PERSONAL NOTES

Mr. J. F. Avila has been appointed Works Manager at the Birmingham Works of Simplex Conduits, Ltd. Some changes have recently been made, and the large amount of munition work the firm is engaged on necessitated Mr. Avila leaving London at very short notice. For the last nine years he has acted as London manager to the Company, and has been in touch with many electrical men in the London district. Mr. Avila regrets his hurried departure prevented him taking leave of the majority of them.

An engineer with electrical and mechanical training is required for the Imperial Bacteriological Laboratory, Muktesar, India. Salary, 350 to 400 rupees per month, rising to a maximum of 500 rupees per month. Three years' agreement. Director-General of Stores, India Office, S.W. November 1st.

Mr. J. H. Clifford, at present Junior Engineer-in-Charge at the Belfast Electricity Works, has been promoted to the senior position, and Mr. Girvan, switchboard attendant, has been promoted to succeed Mr. Clifford.

A switchboard attendant is required in the Wakefield Electricity Department. Borough Electrical Engineer.

Electrical Engineer wanted by British Dyes, Ltd. (See an advertisement on another page.)

Electrical Engineer wanted for small Irish town. (See an advertisement on another page.)

Plumber-Jointer wanted in Newport (Mon.) Electricity Department. (See an advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £87 10s. to £88 10s. (last week the same).

Openings for British Trade.—The weekly list of articles concerning which the Board of Trade Commercial Intelligence Branch has received inquiries includes metal filament lamps, corrugated packing material for electric lamps, and porcelain goods for electrical purposes.

Plant for Sale.—The liquidator of the Diesel Engine Co., Ltd., and Consolidated Diesel Engine Manufacturers, Ltd., offers for sale the whole of the remaining engineers' stores and other property at Ipswich of these Companies. Full particulars are given in an advertisement on another page.

LOCAL NOTES

Cheadle and Gatley: Bulk Supply.—The Manchester and Stockport Corporations are to be asked for terms upon which they will supply electricity to this district.

Grenock: Electricity Accounts.—After meeting capital charges and allocating £2,442 to depreciation, there was a net profit on the working of the electricity undertaking for the year to June 30th of £10,397. The number of units sold, viz., 14,207,575, show an increase of 21·4 per cent. over the previous twelve months, but in this connection it is to be remembered that the year includes eight months of the supply to Port Glasgow, which has had the effect of adding 1,632 kw. to the connected load.

Liverpool: Progress of Electrical Undertaking.—At the final meeting for the year of the Tramways, Electric Power &

Lighting Committee Mr. Russell-Taylor, who presided, reviewed the progress of the undertaking. The capital expenditure to the end of 1914 amounted to nearly 2½ million pounds, and the revenue for the year was £300,000. Since the taking over of the business of the old Company, the profits have enabled £862,128 to be repaid off capital, £390,000 has been carried to reserve, depreciation, &c., and £285,000 had been allotted to relief of rates, the contribution on this account for the current year being £25,000. The number of consumers now amount to 11,500, compared with 10,800 last year; whilst the total number of units supplied for all purposes amounted to 48 million. Special reference was made to the advantage, to small users, of motors on hire, whilst the application of the same principle to electric cooking and heating apparatus has had similarly beneficial effects.

Maidstone: Electric Wiring: Co-Partnership.—In his report for last year, Mr. E. E. Hoadley, the Borough Electrical Engineer, once more urges the need for powers to hire out cooking and heating appliances. Electric cooking, he says, is still throttled by the want of these powers, but, as no doubt Mr. Hoadley fully recognises, there is little prospect of any movement in this direction at the moment. Notwithstanding the difficulties occasioned by the war, the undertaking last year showed a net profit of £1,558, the largest surplus obtained since the works were started. All branches of supply show an increase except street lighting and tramways. The power units now form more than half the total output, and showed an increase last year of 31 per cent. over the previous year. Reference is also made in the report to the fact that the Department has been able to sell to the Government at satisfactory prices three 150-kw. sets, which were very much out of date for an undertaking of the size to which Maidstone has now grown. Nevertheless, the sets were exceedingly efficient for the purpose for which the Government wanted them, viz., wireless telegraphy. As the result the Electrical Department was able to put down larger and more economical plant, viz., a 1,250-kw. Ljungstrom turbine. At the end of the report the Committee is asked to give consideration to a co-partnership or bonus scheme.

Taunton: Cooking Apparatus.—At the last meeting of the Corporation, Alderman Van Trump protested against money being spent upon electric cookers for hiring out, on the ground that unless current could be supplied at ½d. per unit they could not compete with coal or gas.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Callender's Cable & Construction Co.—An interim dividend at the rate of 10 per cent. per annum, less tax, is declared on the ordinary shares for the June half-year.

Dick, Kerr & Co.—The accounts for the year to June 30th show a net profit of £36,100, which is £2,600 in excess of the previous year. The last dividend on the ordinary shares was 5 per cent. in 1910-11, but none has been paid since that. The directors, however, consider it in present circumstances inadvisable to do so now. The sum of £25,000 is set aside as reserve for contingencies, and after bringing in the balance from last year a sum of £18,300 is carried forward.—At the meeting on Thursday, the chairman, Mr. C. T. Cayley, said that the Company was living, as it were, from hand to mouth. All normal development had been stopped, and the energies of the staff had been transferred to the special requirements of the time. It was because the present conditions held out very little hope of large profits that the directors thought it wise not to recommend a dividend on the ordinary shares this year. The position with regard to profit on the Government work was doubtful at the moment. It was hoped that some reasonable profit proportionate to the efforts being made would be permitted.

Ferranti.—There was a trading profit for the year to June 30th of £37,230, but the balance for distribution is £18,789, which includes £2,050 brought forward. From this is deducted interest on the first mortgage debenture stock, interest on the five-year notes, and interest on bank loans, and, after adding £10,000 to depreciation reserve, a balance of £1,028 is carried forward. The results for the year show a falling off, but this is mainly due to the dislocation of export business due to the war and adverse monetary conditions. Extensions have been made to the Company's works in order to carry out additional work for the Government.

Companies Struck off Register.—The names of the following have been struck off the register of Joint Stock Companies:—Consolidated Electric Works & Appliances, Ltd.; Gamble's Patent Telephone Recorder Co. (Continental), Ltd.; Hayward's Heath Electric Supply Co., Ltd.; Radio & Electric Power Co., Ltd.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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Rates for Small Prepaid and Official Advertisements, see p. vi.
Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 208-206, TEMPLE CHAMBERS, LONDON, E.C.

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SUMMARY

THE first of a course of six lectures on electric heating and electric furnaces was delivered by Dr. Fleming at University College on Friday, October 29th (p. 442).

AT the Birmingham Local Section of the I.E.E., Lieut.-Colonel J. F. Lister delivered his Chairman's address on October 27th, on the subject of the application of electricity to military communications (p. 442).

THE Admiralty Recruiting Department points out the advantages of service in the Navy for skilled engineering workmen (p. 442).

MR. A. NICHOLS MOORE, the Newport (Mon.) Borough Electrical Engineer, makes an interesting contribution to our correspondence columns on the effect of enlistment on electricity undertakings (p. 443).

ADDITIONAL regulations have been made under the Defence of the Realm Act, giving increased powers to the Comptroller of Patents to prohibit publication of patents relating to war material, &c. (p. 443).

WE refuse to believe that the miners of Great Britain are cowards, no matter what resolution may be passed by the Miners' Federation (p. 444).

IN his Presidential Address to the West of Scotland branch of the Association of Mining Electrical Engineers, Mr. A. B. Muirhead criticised some of the methods used for underground electric lighting, and dealt with several other matters of interest (p. 444).

IN the Thomas Hawksley Lecture last week before the Institution of Mechanical Engineers, Dr. Dugald Clerk commented upon the doubtful possibility of any further increase in the present size of gas engines using reciprocating pistons. He expressed the opinion that developments in the gas turbine must be made to compete with the steam turbine (p. 445).

THE utility of surface earthing at collieries was severely criticised by Mr. W. Webster in a recent Paper before the Association of Mining Electrical Engineers (p. 445).

THE patent specifications relating to electrical working in mines published during the last month include two relating to shaft signalling and one describing an alarm bell for giving notice of movements of roof (p. 445).

AN instructive comparison between electricity and compressed air for coal-cutting was made in the course of a recent Paper by Mr. Sam Mavor (p. 446).

AMONG the subjects of specifications published by the Patent Office last Thursday were catenary contact line suspension, cable compound, thermal switches, and microphones (p. 447).

OUR Questions and Answers column this week deals with the effect on commutation of wrong connections between an armature and commutator (p. 447).

A DESCRIPTIVE account is given of an Edison electric motor lorry recently supplied to the Blackpool Co-operative Society (p. 448).

NEW plant is required at Gloucester (£25,000); gas-driven generating sets in New Zealand; mains at Stoke-on-Trent; and coal-handling plant at Sheffield and Ipswich; and three 100-k.v.a. transformers and switch panels at Erith (p. 449).

A LOAN for ordinary extensions has been refused at Wolverhampton.—A new 5,000-kw. turbo-alternator and two 1,500-kw. rotary converters have been started up at Bradford (p. 450).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D.,
COMMANDANT.

Drills, 6.15 to 7.15; 7.15 to 8.15.

(To-day) Thurs., Nov. 4th: Section III., technical. Section II., shooting, or working party.

Fri., Nov. 5th: Section IV., technical. Section I., squad or working party.

Sat., Nov. 6th: Company Parade, 2.30 p.m.

Mon., Nov. 8th: Sec. I., technical. Sec. III., squad or working party.

Tues., Nov. 9th: Sec. II., technical. Sec. IV., shooting or working party.

Thurs., Nov. 11th: Sec. III., technical. Sec. I., shooting or working party.

Fri., Nov. 12th: Sec. IV., technical. Sec. II., squad or working party.

Sections for technical drill will fall in at the Headquarters of London Electrical Engineers (T.F.), 46 Regency Street, S.W.

Sections for squad, signalling, shooting, and working parties will fall in at the new Headquarters.

Volunteers for trench work on Sunday, Nov. 7th, are requested to give early notice to their Section Commanders. It is hoped that as far as possible the men who attended on the 31st ult. will attend again on the 7th inst.

For "Arrangements for the Week" see p. 449.

ELECTRIC HEATING AND ELECTRIC FURNACES

THE first of a course of six lectures on electric heating and electric furnaces was delivered by Prof. J. A. Fleming, D.Sc., F.R.S., at University College on Friday last. He referred first to the various types of thermometer for the measurement of temperature, mentioning the standard nitrogen in quartz constant-volume thermometer at the International Bureau of Standards. Reviewing briefly Lord Kelvin's device of the measurement of absolute temperature by the reversible heat engine method, Dr. Fleming passed on to the main theme of his lecture, the measurement of high temperatures. He explained the Stefan-Boltzmann law, relating the energy radiated from a black body to its absolute temperature, and exhibited curves showing the distribution of radiant energy in the spectrum from violet rays to dark heat rays. Wien's law—that the product of wave length in microns of a ray of maximum energy, by absolute temperature, is equal to a constant (approximately 2,940)—was given, and it was shown how this principle, though not very convenient, could be used for the determination of temperature.

Turning attention to the commercial methods of high-temperature measurement, the lecturer reviewed the three different principles on which these were based, viz., the variation of resistance with temperature, the thermo-electric properties of materials, and the laws of radiation. In connection with these three principles, brief descriptions were given of (1) the platinum thermometer with compensating leads, now very much used, particularly for measurements of temperature from a distance; (2) the laws relating to thermo-electric power and the Holman formula for the E.M.F. in a thermocouple; and (3) the Féry radiation pyrometer. In the course of the lecture a very interesting instrument made by the Cambridge Scientific Instrument Co. was shown, known as a "thread recording thermometer." This was built in a similar manner to the ordinary recording instruments, except that instead of a pen moving over the paper, an inky thread was suspended between the pointer of the instrument and the paper, and a clockwork arrangement caused a lever to press the pointer on to the thread and paper once a minute, thus making the record by a series of dots, while the pointer was free to move without friction.

Five further lectures are to be given in this course, covering the following subjects:—Electric resistance heating and various types of resistance furnaces; arc furnaces; the applications of electric heating to the manufacture of various substances such as graphite, calcium carbide, aluminium, &c.; the electric production of iron and steel; and domestic heating and cooking.

APPLICATION OF ELECTRICITY TO MILITARY COMMUNICATIONS

ON Wednesday, October 27th, Lieut.-Col. J. F. Lister delivered his address as Chairman of the Birmingham Section of the Institution of Electrical Engineers.

For those who are not conversant with telegraph instruments, he said, it might be advantageous to say a few words about the instruments employed in the field. The Morse alphabet, which is used by all countries employing the Roman alphabet, is formed by various combinations of two distinct signals, on the principle that the most commonly used letters are formed by the shortest signals. In the instruments used for military purposes, the difference between the two signals is the difference of duration, one signal, known as a dash, being three times the length of the other, known as a dot. The interval between the component dots and dashes forming a letter is equal in duration to one dot, that between each complete letter forming a word to two dots, and that between words to three dots. The dots and dashes are sent by pressing a key, and thereby completing a circuit for the requisite duration of time. Using ordinary direct current, the signals are produced at the other end by the attraction of the armature of an electro-magnet, signals being read by the duration of time between the two clicks made by the armature on being attracted to the poles of the magnet, and on being released on the cessation of the current. A set made up in this way is known as a single current set, but it is obvious that to work a set of this description over any distance would entail prohibitive battery power, and therefore a relay is introduced at the receiving station. When a relay is employed, the coils of the sounder magnets are replaced by the coils of a relay magnet, which, when the circuit is completed, causes the armature of the relay to travel from one stop to another. It is possible by a method based on the principle of divided circuits to operate and receive at the same time at both ends of a single line; this is called duplex working, the method working at one end at a time being known as simplex. It is possible to duplicate duplex working, known as quadruplex, thereby causing four messages to be sent simultaneously—two in each direction—but in practice it is found

that the method is usually impracticable in the field owing to the high standard of insulation required in the lines. Furthermore, military traffic differs from ordinary commercial working, in that periods of greatest pressure are usually in one direction only. To enable heavy traffic to be dealt with on the lines of communication, Wheatstone is the most suitable system that can be employed, and full advantage is taken of these instruments. The principle of Wheatstone is, instead of the impulses being sent by an operator, perforated tapes are punched out, which, on being fed through the apparatus, cause the necessary impulses to be sent out, and to be printed in dots and dashes on a tape at the receiving end. Any number of clerks can be employed in punching the perforated slip, and a great deal of work, such as casualty lists, indents, returns, &c., can be punched during quiet times of the day.

The vibrator is an instrument which was specially invented for military work. In the vibrator system the signals, instead of being intervals of silence between sharp and distinct sounds, are given by long or short buzzes in a telephone receiver, separated by periods of silence. To produce these signals in the receiver a rapidly vibrating current is required—the period of vibration being about 150 to 500 a second, or those of sound waves. If the period is kept constant a more or less musical note is produced in the receiver.

For short vibrator lines it has been found necessary to provide single current sets, which are used whenever the cable line is down for some time, the cable itself being poled or raised from the ground by tying to trees. This is principally to avoid induction in the office, and, being on short distances, excessive battery power is not required.

Besides vibrator sets, a portable telephone and vibrator is used for brigade signalling, and for lineman's work on the lines. The additional condenser which is carried in the body of the instrument enables the lineman to work an ordinary circuit without interfering with signals which are being sent. A vibrator line can also be tapped at any point, and the signals read. When a vibrator is superimposed in an ordinary direct current set, it is necessary that there should be a certain capacity and self-induction in the line between the direct current and the vibrator sets; this is usually inserted specially by means of an apparatus known by the name of a separator.

The instruments used in a signal office are generally carried, made up, so that connections, upon opening an office, are reduced to a minimum. The incoming lines are usually laid either on to a commutator or terminal board, so that sets may be changed from one line to another without the necessity of re-connecting the whole office up again.

Lightning protectors are either carried on the terminal board or baseboard of instrument sets.

Besides the main work of the signal service which has been slightly sketched above, it is usual when a staff is stationary for some period to provide a small telephone system between the various offices, which system very often grows to a considerable size. Telephones are not suitable for sending messages when firing is going on.

Wireless forms a special branch of signal work, and it is not advisable at the present time to make any mention of the methods employed.

At the conclusion of his lecture Colonel Lister described with the aid of a highly interesting diagram the telegraphic arrangements of a recent battle, giving a realistic idea of the complicated and elaborate nature of the telegraphic service employed in the field.

ELECTRICAL WORKMEN FOR THE NAVY

THE Admiralty Recruiting Department wishes to make known more fully the advantages of service in the Navy for skilled engineering workmen. Transference from munition work to the Navy is not encouraged, but amongst those skilled mechanics who are not at the present moment engaged on munition work there must be many who would be glad to find an outlet for their technical abilities by becoming a member of the Naval Service. It is felt that if the opportunities and the requirements which exist in this respect were more widely recognised there would be no difficulty in keeping up the supply of electrical artificers and engine-room artificers who are needed by the Navy.

This branch of Naval Service has many attractions, not the least of which is the comparatively high pay received, which amounts on entry to nearly £2 per week, and which may be very considerably improved by good service. Such workmen enter the Navy with the rating of chief petty officers, they mess in the Chief Petty Officers' mess, and have the same opportunities for leave when they are in port. If they are sufficiently skilled, they are drafted at once on to a battleship, and their opportunities for advancement to commissioned rank are excellent.

During the period of the war men are accepted between the ages of 21 and 45. For rating as engine-room artificers, men who have experience and are competent workmen in the trades of engine fitters and turners, coppersmiths, boilermakers, and enginesmiths are required. An examination is usually held on entry, but in the case of a candidate who holds a Board of Trade certificate as a first-class or second-class engineer and

can produce certificates of character and ability from the works in which he has learnt his trade, exemption is granted. Engine-room artificers are entered as Chief Petty Officers, a position which carries with it many privileges.

Fitters, turners, and instrument-makers are required by the Navy as electrical artificers. Candidates for this rating are accepted for the period of the war between the ages of 21 and 45. The pay is also the same as engine-room artificers, and an examination in fitting and turning or instrument-making is imposed. Electrical artificers may be recommended for a practical course of training carried out on board the *Vernon*, which is moored at Portsmouth, or on board the *Defiance* at Devonport.

This avenue to naval life is certainly one not to be neglected by the skilled engineer. There is no quicker way of entering for actual service, and none which secures immediately better pay, prospects, and position.

CORRESPONDENCE

THE EFFECT OF ENLISTMENT AND MUNITION WORKING ON ELECTRICITY UNDERTAKINGS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—In your issue of October 7th there appeared a contribution from a central station engineer on the above subject, some of the experiences detailed and the manner in which they have been overcome forming interesting reading.

Such experiences as your contributor brought to notice have, I am sure, by no means been exceptional to the general body of central station engineers.

Regarding the question of wages, the policy of giving war bonuses has been general throughout the country, and has, I believe, reasonably met the exigencies of the case. At the same time the want of municipal co-ordination in dealing with this question has given rise to considerable dissatisfaction in several instances and, in some, created labour difficulties which might have been avoided had a definite basis been decided upon by general conference through some central body, such as the Association of Municipal Corporations, before any decisions were made. So far as Newport is concerned, once the war bonus had been fixed, no further troubles were experienced. It was stipulated, of course, that the municipal bonus should not apply to those employees who had received an addition of wages, whether as a war bonus or general increase in the standard rate through the representation of any trades union or federation. Obviously, had the Corporation done otherwise—that is to say, given the municipal bonus to all—such action would have been tantamount to putting a premium on trades union labour.

I entirely disagree with the policy outlined by your contributor with the object of providing increased wages to those employees not enjoying the benefits of the general increase prevalent due to munition work; to deliberately find work and encourage overtime as compensation is a misguided policy, and one which will certainly reap its just reward when normal conditions are resumed.

As to the methods adopted to retain the staff, if they applied to engineers on the staff I am afraid it was rather a high-handed policy! I am not aware that there is any power existing at the present time under the Defence of the Realm Act or any Order in Council made thereunder which empowers Corporations by their chief officials to prohibit their engineering assistants leaving their present employ; such powers as do exist only apply to skilled workmen. I realised this difficulty a considerable time ago, and have since been in communication on a number of occasions with the Ministry of Munitions on this particular point, and they have now stated that the matter is having their careful consideration. It is naturally one upon which a decision cannot be hastily made. I think many engineers will endorse the view that there have been cases where assistants have taken advantage of the present conditions to endeavour to force the hand of the Corporation in the matter of increases. Personally, I have declined in every case to take any man who has applied for a vacancy unless he could produce a letter from his present employer to the effect that such employer had no objection to his applying for the vacancy and would permit him to leave if selected. In cases where I deemed it advisable to give an increase in salary rather than lose the services of the assistant, I had an agreement signed whereby they undertook not to apply for any other post for the period of the war.

Your contributor puts himself on the back in that he put his capital into buildings instead of reducing outstanding liabilities on obsolete plant. I am afraid his satisfaction is rather shortsighted. Present circumstances may apparently justify the policy, but surely such is not altogether to be commended. A prominent L.G.B. Inspector has on more

than one occasion strongly expressed himself on this point. The important question as to the way in which municipal undertakings not possessing ample reserve funds are going to deal with the question of mains and services extensions, now that the Treasury have restricted such expenditure to war purposes only, is one which I should have thought your contributor would have specifically referred to and dealt with. To the average undertaking I think the restrictions imposed on this account will be very serious, especially where those undertakings are in competition with gas companies. Many will be unable to provide the capital for these extensions out of revenue, with the result that valuable lighting and heating business will have to be declined, and such consumers once lost are not likely to be regained; moreover, in the case of new houses, this applies even more strongly.

When it is considered how many undertakings are dependent on their lighting and heating load, the seriousness of the position will be appreciated.

I agree with your contributor that the present time forms a magnificent opportunity for the pushing of power supply, not only the large supplies for munition works, but for that very important section the small workshop. In Newport we are to-day conducting a special campaign against obsolete gas engines, and I am glad to say that they are following each other to the scrap-heap with satisfactory regularity. The securing of this load will in some measure compensate for the very probable decrease after the war. I suggest it is rather a pity that your contributor did not omit his dissertation on international politics and finance; evidently by the time he had reached this point he had forgotten the precise subject upon which he set out to write. Exactly what connection there is between international politics and finance and "the effect of enlistment and munition working on electricity undertakings," I fail to appreciate.

In conclusion, I think that the contribution of October 7th, and the further little additions I have been able to add thereto regarding the many important matters that central station engineers have had to deal with since the outbreak of war, must suggest that a very excellent opportunity for the Incorporated Municipal Electrical Association to have been of real national service has been allowed to go by. Never was there such an opportunity afforded for the I.M.E.A. Commercial Development Committee to give a lead.

Yours faithfully,

A. NICHOLS MOORE,
Borough Electrical Engineer.

Newport, Mon., Nov. 1st, 1915.

WAR PATENTS

THE following additional regulations relating to war Patents have been made under the Defence of the Realm Act :—

Where an application has been made, whether before or after the date of the making of this Order, for the grant of a Patent or the registration of a design in the United Kingdom, and the Comptroller-General of Patents, Designs, and Trade Marks is satisfied that the publication of the invention or design might be detrimental to the public safety or the defence of the Realm, or might otherwise assist the enemy or endanger the successful prosecution of the war, he may delay the acceptance of the Complete Specification filed with the application for the Patent, or, as the case may be, the registration of the design, and in such case may by Order prohibit :—The publication or communication in any way of the invention or design; application being made for the protection of the invention or design in any enemy or neutral country; and application being made for the protection of the invention or design in any allied country or in any of his Majesty's Dominions without the permission of the Admiralty and Army Council.

No person shall apply for the grant of a Patent in respect of any invention or the registration of a design in any foreign country, or in any of his Majesty's Dominions, unless he has left at, or sent by post to, the Patent Office, a notice of his intention, together with a Provisional Specification, describing the nature of the invention or, as the case may be, a representation or specimen of the design, nor until after the expiration of one month from the time when such notice was given, and if during the said month the Comptroller-General is satisfied that the publication of the invention or design might be detrimental to the public safety or the defence of the Realm, or otherwise assist the enemy or endanger the successful prosecution of the war, he may make a like Order as in respect of cases in which application is made for the grant of a Patent or the registration of a design in the United Kingdom.

Before exercising any of his powers under this Regulation as respects any matter, the Comptroller-General shall consult with the Admiralty and Army Council and shall not act except upon the request of the Admiralty or Army Council.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

THE MINER'S OBJECTION TO ELECTRICITY

A STOCK subject for a resolution at any general meeting of miners is one complaining of the dangers of electrical machinery and calling for its suppression. At the annual conference of the Miners' Federation of Great Britain last month this was not forgotten. A delegate moved a resolution to the effect that electric coal-cutters should be prohibited by legislation, and this was passed, with power given to the executive—on the suggestion of the President—to widen its scope by including the use of electricity for all purposes as dangerous.

The reports of the inspectors for the various districts which we publish regularly in our columns show that the fatal accidents attributable to electricity are extremely few, and are almost invariably due either to neglect of rules or to carelessness on the part of the workmen. Moreover, the men themselves know this very well, and the real cause of their antipathy to electricity is that it is labour-saving. During the present time, however, it is a patriotic duty to encourage labour-saving devices of every description so as to release as many men as possible for military service.

We do not admit the danger of properly-used applications of electricity in mines; but even if such danger did exist, it is nothing to the danger which the men who have left the mines to fight in France, Flanders, and the Dardanelles have to undergo. Large numbers of miners have gone abroad to risk their lives in the country's service; coal is needed for the manufacture of the guns and ammunition they require and to supply the Fleet whose blockade will hasten the ultimate collapse of the enemy; every device which increases the output is of assistance to those who are placing themselves in the position of the greatest danger, and, if the risk of using it were a thousand times what it is, those who are obliged to stay at home should willingly incur it. We refuse to believe that the miners of Great Britain are cowards, no matter what resolution may be passed by the Miners' Federation of Great Britain.

ELECTRICITY IN SCOTTISH MINES

THE West of Scotland Branch of the Association of Mining Electrical Engineers recently held its opening meeting for the session at the Royal Technical College, Glasgow. The President, Mr. A. B. Muirhead, gave an inaugural address on the subject of "The Development of Electricity in the Scottish Mining Industry."

He said that a *résumé* of the position of this development would be useful at the present time, as we are now sufficiently far from 1911, when the present Code of Electricity Rules applicable to mining became law, and sufficiently near to 1920, when plant installed under the Code of 1904 must be removed from active service in order to comply with the law.

Scotland, said Mr. Muirhead, takes no mean place as a coal-producing country, as the yearly output has now reached about 42,500,000 tons. Mining development has been rapid, for in the past thirty years the output has increased by 22,000,000 tons. The coal may be said to be "hardly" won, for the mining conditions are hard and uncompromising. The difficulties incidental to Scottish mining have not always been understood and appreciated by legislators hailing from across the Border, who have seen fit to make laws to govern and direct all British mining operations as if there was only one colliery, one seam, and one set of conditions to be met. This reference to legislation—made in all sincerity and with good intent—might, Mr. Muirhead suggested, receive the attention of broad-minded men in

the Department concerned. The difficult nature of Scottish mining has resulted in a marked development in the use of electricity for power purposes, above and below ground. Electricity has been harnessed and used to counteract the natural obstacles to a greater extent than in any other division of the British coalfield, and the advantage of its extensive use is borne out by the fact that although the difficulties are great, the output per person employed above and below ground in the Scotland Division reached 321 tons in 1913 (reduced to 298 tons in 1914), whereas the next highest was in the Yorkshire and North Midland Division, where the output in 1913 was 286 tons per man (reduced to 258 tons in 1914).

Then followed a reference to the work done by the pioneers twenty years ago, to some of the difficulties they had to overcome, and the rapid progress they made. A winding equipment on the Thury series system was described, and was said to be mechanically and electrically first class. With regard to underground electric lighting, the speaker said this had a tendency to follow too closely the practice adopted in factories. Care had not always been taken to ensure that the types of cable and fittings were suitable for underground conditions. A result of using cables and fittings adapted for use above ground has been that the maintenance of electric-lighting systems underground has occupied the time of the colliery electrician to an even greater extent than the much more important power circuits required. Small unarmoured wires insulated with rubber tend to get damaged, and the cleats used for keeping each wire in its proper place are easily broken and displaced. The ordinary lampholder is not mechanically strong, and, for underground conditions, especially where dampness exists, it soon becomes a source of trouble. In some cases the wiring has been carried out in tubing, and owing to the condition of the atmosphere the wires have quickly deteriorated inside the tubing, causing breakdown and necessitating renewal. It has also been found somewhat difficult to keep the tubing continuous, with the result that damage to wires has occurred. The breaking of the continuity of the tubing sets up a serious source of danger. It has been customary to adopt as a lighting pressure the voltage in use at the colliery for power purposes, and Mr. Muirhead advocated that this practice should be continued for pressures up to 500 volts. It is better, he said, to make the cables and apparatus safe mechanically and electrically rather than resort to mixed-voltage systems, or to be under the necessity of installing motor-generator plant or step-down transformers, as the case may be.

Tables were given indicating the growth in output of coal in Scotland during the last forty years, the number of electrical and air-driven coal-cutters in use since 1910, and the number of electrical accidents from 1910 to 1914. After some comments on these tables, Mr. Muirhead concluded his address, saying that if—as an Association—they wished to render the best assistance in our power to the development of electricity in our coalfield, it is necessary that they should consider persistently and with unabated earnestness the training of the men who are called upon to handle electrical apparatus underground. The men employed on such work in Scotland do not differ materially from those in the other centres in the United Kingdom, in that they are inclined to neglect the most obvious precautions made for their safety. It is necessary to interlock handles of apparatus and devise "fool-proof" fittings, that they may be protected from the results of their own ignorance or carelessness. One still heard of men being injured when replacing fuses on circuits that have not been switched off; hence the necessity for interlocking fuse and switch boxes so that current must be cut off before doors can be closed. Each member of the Association should make it his business to point out consistently and constantly the little precautions, and the most obvious precautions, which must be taken to ensure that electrical plant will be handled properly below ground. By so doing they can support the colliery manager and follow up the work of the manufacturer and the designer of electrical plant. Thus each in his own particular sphere can further the important work of the development of electrical power in the Scottish coalfield.

THE WORLD'S SUPPLIES OF FUEL AND MOTIVE POWER

DR. DUGALD CLERK, in the Thomas Hawksley Lecture before the Institution of Mechanical Engineers in London on Friday last, Oct. 29th, took as his subject the supplies of fuel and motive power in the world, and pointed to some directions in which economies can be made which he anticipates should have the effect of doubling the possible industrial life of the world. The lecture has yet to be repeated at Manchester, Glasgow, Newcastle, and possibly one or two other provincial centres, and until this has been done the Institution does not consider that the lecture has been "delivered." Consequently for the present we are asked to give only an outline of the lecture, and it may be pointed out that owing to lack of time Dr. Dugald Clerk omitted on Friday to read certain notes which he had prepared upon large power stations.

Naturally most emphasis was laid upon the possible duration of our coal supplies, although references were made to the use of water power and oil. Incidentally we may mention that Dr. Clerk made no reference to the possibilities of home-produced alcohol for internal combustion engines. This, of course, does not come directly within the scope of electrical engineering, but it certainly is a subject to be taken into account in any consideration of the world's supply of motive power. As to the coal supplies in Great Britain, Dr. G. T. Beilby's estimate was quoted that if every possible use was made of electric power and gas engines employed for generating electricity no less than sixty million tons of coal per annum could be saved, whilst the same amount of work as at present could be achieved. That estimate, however, was before the rapid progress of the steam turbine, and Dr. Beilby has since revised his opinions as to the possibilities of gas-driven generators. Nevertheless, all the tendency, said Dr. Clerk, was towards proving that Dr. Beilby's original estimate was true. Various other figures were given of estimated economies in the use of coal, and the final result was the conclusion that the industrial life of this country, which necessarily depends upon our coal supplies, is capable of being doubled. In other words, our coal supplies could be made to last for 1,000 years instead of 500 years.

The lecturer conceded that anticipations in the development of large gas engines have not been realised, and that the practical difficulties of weight encountered when cylinders of a larger diameter than 15 inches were built had so far really proved insurmountable. To double the size of a gas engine cylinder involves doubling the total weight of the engine, and the extraordinary efficiency of the steam turbine at present has convinced gas engine builders that it is not worth while to proceed beyond cylinders of about 15 inches diameter. Consequently 5,000 h.p. was about the limit to which a gas engine at present could go, whereas a 5,000 h.p. steam turbine formed quite an ordinary unit for an electric power station. Dr. Clerk sees little hope of an indefinite increase in the size of gas engines using reciprocating pistons, and it was towards the gas turbine that engineers must turn if effective competition with the steam turbine is to be made. Although considerable work had been done upon the gas turbine, no success had yet been achieved. The thermal efficiency could be taken at about 15 per cent., and although in 1912 an efficiency of 23 per cent. was claimed, even this was not anything like the efficiency of the cylinder gas engine. At the end of 1911 no less than 6½ million h.p. of Parsons turbines were in use, mostly for electric power stations.

UTILITY OF SURFACE EARTHING CRITICISED

IN a recent Paper read before the East Scotland Branch of the Association of Mining Electrical Engineers, Mr. William Webster questioned the utility of surface earthing. He first took the case of a three-phase system with earthed neutral, assuming a 500-volt supply with the neutral point of the generator earthed through a resistance of 10 ohms. He assumed further that a fault occurred about 2,000 yards from the source of supply on a three-core 0·4 sq. in. armoured cable. The resistance of the armouring to accord with Special Rule 125 (b) of the Electricity Regulations would be about 0·24 ohms. The potential difference between the neutral point and one main would be 290 volts, so that taking account of the armouring and earthing resistance the current passing would be about 28 amperes. The potential difference between the fault and the station end of the armouring connected to the earth-plate, however, would only be six volts. Thus, even assuming the earth-plate to be making the best possible contact, it would not be carrying any appreciable current, and little if any shock would be felt by a person coming in contact with the switch or motor casing or armouring at the fault. If there were no resistance in series with the neutral point, the current would be considerably increased, the potential differences between the fault and the station end of the armouring would be increased also, and severe shock might be received on touching the casing. On disconnection of the

earth-plate no increase of the potential difference between the fault and the station end of the armouring would take place in either case, but the resistance between the latter and the earth would be considerably increased. This would mean that the potential difference between armouring and earth at the fault would be decreased. Therefore, the author contended that from a safety point of view the earth-plate is useless. He also remarked that in the daily working of a colliery where fuse-bridges have to be withdrawn and replaced direct contact with a live part may occur, and, with the neutral point earthed as in this case, a full voltage of 290 volts would be received.

The author next considered a three-phase system not earthed at the centre, but with ordinary surface earthing of the apparatus and armouring. In this case if a fault occurred no current would pass unless there was another fault on one of the other phases, when the trip would open the circuit. If the latter lags in any way, there may be momentarily a dangerously high voltage between the two points of the armouring, which, however, would not be reduced by the presence of the earth-plate.

The case of 3,000-volt transmission down the shaft was next considered, assuming transformation to 500 volts at some convenient station underground for haulage motors, &c. In these circumstances the shaft cables would be of much smaller section than the low-tension main feeders. According to the Rules, the low-tension apparatus must be earthed at the surface, and the conductivity of the armouring of the shaft cable would have to be reinforced by a separate wire to bring the conductivity up to 50 per cent. of the low-tension core. Nevertheless, it is very doubtful whether any of the leakage current from a fault on the low-tension side would pass through the surface earth-plates.

Lastly, a D.C. 500-volt system was considered with the ordinary earthing on the surface. Assuming 0·3 sq. in. twin-core armoured cables feeding two pits, each feeder being 2,000 yards long, the resistance of the armouring would be about 0·3 ohms for each cable. If a fault were to occur at point A at the far end underground in one of the pits, no interruption of the supply would take place, and there would be no danger of shock. If another fault were to occur at point B in the other pit and on the opposite pole, a potential difference would be set up between A and B, and, with the motors on concrete foundations, the resistance between A and B would be fairly high. The leakage current would flow through the armouring from A to B, and the potential difference between A and B might be 100 volts or more, depending on the nature of the faults. To reduce this, the resistance between A and B through the earth would require to be decreased at or near these points, and owing to the difficulty of making a good earth there, even this might prove futile. Again, as in the three-phase systems, the surface earth-plates would not be brought into action.

On the other hand, the author admitted that if the armouring is not carried right through, his arguments do not necessarily hold, for instance, in systems where the tails entering a motor are left open, where there is open type switchgear where the wiring could come in contact with the earth, or where unarmoured cables are used. In such cases earth-plates at the surface do come into active operation.

Although there is no compulsion to instal earth-plates underground, it is to be recommended in many cases.

ELECTRICAL MINING PATENTS FOR OCTOBER

IN Specification No. 19,854 of 1914, the Sterling Telephone & Electric Co. and H. W. Barclay describe a signalling system for mines, in which visual signals distinctive of a number of different signalling stations are each adapted to be put in circuit upon the commencement of a signal from any other station, while the signalling apparatus proper, capable of giving audible and visual signals, is common to all the signalling stations, and can be appropriated by any one of them, and any signal given is cleared by the commencement of a fresh signal, whether by the same or another signalling station.

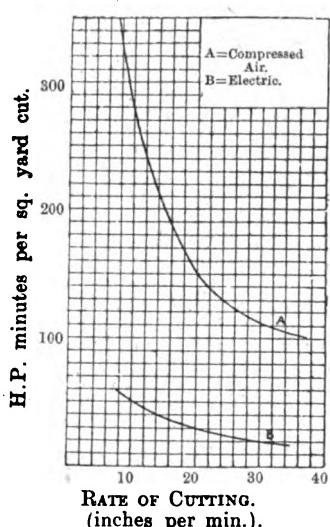
Another specification relating to shaft signalling is No. 17,000 of 1914, by G. F. Black. In this improved system the hand-signalling lever and its connections to the bell and indicator are arranged so that the transmission and wiping out of the signals are both effected by the same lever, the movement of which when giving a fresh signal wipes out the previous one.

J. P. O'Donnell describes in Specification No. 1,119/15, communicated by G. D. Hodges and D. Smith (Johannesburg), a form of alarm bell for giving notice of movements of

roofs, &c., which is self-contained in that the bell, battery, &c., is attached to a readily adjusted telescopic bar which can be placed in any gallery, and will make a contact to ring the bell on a movement of the roof of a predetermined amount.

COMPRESSED AIR v. ELECTRICITY FOR COAL CUTTING

IN the course of a Paper on "Compressed Air for Coal-cutters," read recently before the Institution of Mining Engineers, Mr. Sam Mavor included the curves below to illustrate how sensitive to change of load is the efficiency of a compressed air coal-cutter, and how much more its power efficiency in operation is dependent upon the skill of the driver than is the case with an electric machine. The curves are drawn from results of actual tests, and the compressed-air and electric machines are represented on the same scale of energy, the compressed air, and the electricity supplied to the machines being reduced to the equivalent brake horsepower hours. The form of the curve of the electrically-driven machine may be taken as closely approximate for all electrically-driven coal-cutters. The curve of the compressed-air machine will not bear such wide application; it refers to a particular machine, and, although fairly characteristic, its form is only to be taken as roughly representing compressed-air machines in general. The positions of the curves on the scale depend—other things being equal—upon the hardness of the materials cut by the machines. The two machines tested worked under similar conditions, cutting in easily-holed coal, and the two curves given are therefore comparable both as to their forms and their positions on the scale. The favourable position of the electric machine on the scale is due to its working in a closed circuit, and having no exhaust pipe from which to vomit unused a large proportion of the energy supplied to it.



Rights of Patent Licensees.—In the Court of Appeal on Oct. 20th, before the Master of the Rolls, Lord Justice Banks, and Lord Justice Warrington, judgment was given in an action by the Diamond Coal Cutter Co. against the Mining Appliances Co., which raised an interesting point in patent law, not only with regard to mining but generally. The Mining Appliances Co. are exclusive licensees for a coal conveyor operated electrically. The owner of the English patent is a German residing in Germany, and the action by the Diamond Coal Cutter Co. was to restrain the Mining Appliances Co. from issuing threatening circulars to their customers against using alleged infringements of this patent. The point put before the Court was that by this circular, the licensee claimed all the rights of a patentee, which it was argued the Patents Acts do not confer. The Master of the Rolls in giving judgment, said that the word "patentee" is defined in the Act as a person for the time being entitled to the benefit of a patent, although it was clear he thought that a mere licensee was not a patentee within the meaning of Section 36 of the Act. The point at issue was whether the defendants had by their circulars brought themselves within this Section. Mr. Justice Eve in the Chancery Court had refused to grant an injunction. The documents in question, he said, stated that the Mining Appliances Co. were not the patentees, but were exclusive licensees, and any proceedings which were threatened against users of alleged infringing apparatus were expressly stated to be under their license. That being so, he did not think the Company was liable to an action under Section 36 of the Patents Act, which defined the rights of a patentee. On the other hand, they might be liable to action at common law, but only if malice could be proved. The other Lords Justices agreed.

Association of Mining Electrical Engineers.—The annual meeting of the Association of Mining Electrical Engineers was held in Manchester early last month, when the awards for Papers read during 1914-1915 session were presented. A committee was appointed to investigate the financial position of the Association, and the President, Mr. R. Holiday, called attention to the need for carrying on the work of the Association, notwithstanding the interference with the ordinary course of things which the war had involved. He also mentioned that a scheme for holding classes at certain collieries, at which attendance would be open to members and non-members of the Association, was to be tried.

WE MANUFACTURE

ALL CLASSES OF

PAPER INSULATED

RUBBER INSULATED

AND

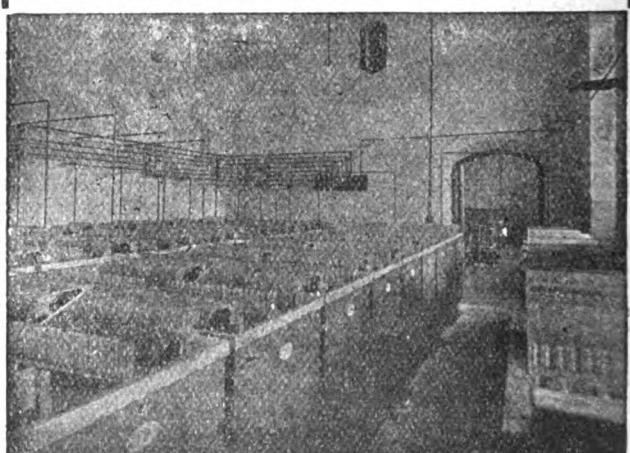
BITUMEN INSULATED

CABLES

THE UNION CABLE
CO., LIMITED,

DAGENHAM DOCK, ESSEX.

TUDOR ACCUMULATORS FOR COUNTRY-HOUSE LIGHTING



STONELEIGH ABBEY, KENILWORTH.

Battery of 56 cells, 1940 ampere-hours.
(Plant supplied by Midland Electric Light & Power Co., Ltd.)

SMALL BATTERIES from 35 AMP.-HOURS UPWARDS.

ASK FOR PRICE LIST of COMPLETE BATTERIES for
25, 50 and 100-volt INSTALLATIONS.

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3, Central Buildings, Westminster, London, S.W.
WORKS DUKINFIELD near MANCHESTER.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Oct. 28th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

20,557/14. **Overhead Conductors for Electric Railways.** B.T.-H. Co. (*G.E. Co., U.S.A.*). A catenary system of contact line suspension, in which several conductors are suspended side by side from one messenger wire with the points of suspension arranged in recurrent succession. (5 figures.)

23,778/14. **Thermal Switches.** G. WILKINSON. Switches actuated by the expansion of mercury in which a chamber of glass envelops the capillary tube where the make and break takes place, filled with inert gas and sealed by immersion in mercury. (3 figures.)

4,820/15. **Cable Compound.** R. C. SHARP. A compound for filling cable conduits, &c., consisting of pitch or bitumen, to which is added while in the molten state finely ground and pulverised spent shale.

5,174/15. **Telephone Transmitter.** E. M. C. TIGERSTEDT. A microphone with a tubular diaphragm of non-conducting material with electrodes formed of separate annular segments, adjacent segments being of opposite polarity, and the space between them and the diaphragm being filled with granular or powdered carbon. (3 figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Electrometallurgy and Electrochemistry: WEBB and WILLIAMS [*Electrolytic bleaching*] 20,714/14.

Heating and Cooking: QUAIN [*Electric heaters for ironing and other purposes*] 20,721/14.

Ignition: FEENY (*Fabrik Elektrischer Zunder Ges.*) [Blasting fuses] 14,224/14; WILSON and SHEPHERD [Ignition apparatus for internal combustion engines] 20,776/14.

Switchgear, Fuses and Fittings: PICKETT [Switching devices] 14,146/14; HEATE & KEITH [Automatic tumbler switches] 20,896/14; OTTINETTI [Press-button switches] 2,787/15; LANDIS & GYA A.G. [Motor actuated switches] 9,015/15; WALLACE NOVELTY Co. [Lamp stand] 9,509/15; STEVEN [Switches for lift control] 9,806/15.

Telephony and Telegraphy: MARKS (*International Quadruplex Co.*) [Telegraphy] 16,343/14; MUSSO [Transmission of impulses over circuits of high electrostatic capacity] 18,511/14; LAVALLEY [Telephone locks] 10,054/15.

Traction: SMYTH [Car lighting] 22,062/14, 6,715/15; ALBION MOTOR CAR CO. & MURRAY [Car lighting] 11,139/15.

Miscellaneous: BROWN [Signals] 22,199/14; TULLOCH [Electric ordnance] 2,636/15; NEWELL and MARX [Electromagnetic extraction of foreign substances from paper pulp] 2,865/15; MEIROWSKY & Co. [Condensers] 5,498/15; SIEMENS & HALSKA A.G. [Fire alarms] 6,457/15; WILSON [Condensers] 10,251/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Heating and Cooking: HELLER [Cooking] 14,405/15.

Traction: BRITISH WESTINGHOUSE Co. [Combined engine starter and ignition arrangement] 13,985/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

Dynamos, Motors, and Transformers: SIEMENS BROS. DYNAMO WORKS and W. PARKER [Prevention of sparking in D.C. turbo-generator] 16,051/07.

Heating and Cooking: H. J. DOWSING [Combined radiators and convectors] 15,591/02.

Incandescent Lamps: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Metallic carbon filaments] 14,867/08.

Switchgear, Fuses, and Fittings: SIEMENS BROS. DYNAMO WORKS and E. SCHAPP [Controller contacts] 16,537/09.

Traction: SIEMENS BROS. DYNAMO WORKS, LTD., and L. DE M. G. FERRIERA [Railway points and signals] 14,697/08.

Miscellaneous: J. S. STEVENS, C. G. MAJOR, E. C. and P. H. STEVENS [Electric lift control] 15,764/02.

tions be fitted to either type, and if so, is it advantageous to do so?—“Enquirer.”

(Replies must be received not later than first post, Thursday, Nov. 11th.)

ANSWERS TO No. 1,465.

A 20 h.p. D.C. motor has its armature lap wound with six conductors per coil, arranged in the slot in this order: 1, 2; 3, 4; 5, 6; i.e., two side-by-side and three deep per coil. In replacing a faulty coil the conductors may have been connected to the commutator so as to change their order numerically in the same slot thus: 2, 1; 6, 5; 4, 3. Would this change be detrimental to the running of the machine, enough to cause sparking?—“BOOSTER.”

The first award (10s.) is given to “Y. Z.” for the following reply:—

The question does not contain enough data to enable a perfectly definite answer to be given, but some general considerations may be set out. There is no statement as to whether there are equalising connections on the armature or not. On so small a motor as 20 b.h.p. they would, perhaps, not be fitted, and hence any results in the shape of cross-currents due to lack of symmetry would appear at the brushes, and, if sufficient in magnitude, would cause some sparking. The question does not make clear either whether the expression “coil” denotes all that is between two commutator parts or if it means that the six conductors fill up half the slot and are connected actually to more than one commutator segment, i.e., to two, three, or six segments. If the whole coil of six turns is between two segments, then the actual arrangement of the wires should not make any material difference, as all the six turns are in series, and the total E.M.F. of the coil would be equal to the E.M.F. of any other coil, and in phase with the coil at the opposite side of the armature which is commutated at the same time. As a 6-turn lap winding is somewhat unusual, however, it seems more likely that there are two, three, or six segments

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under “Answers to Correspondents,” or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a “nom de plume,” but, both in the case of questions and answers, the competitor’s real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor’s decision is final.

QUESTION No. 1,467.

Explain the relative advantages and occasions for using duplex re-entrant (symbol ) and duplex non-re-entrant (symbol ) windings on direct-current armatures. Can equalising connec-

to each coil. In that case it should be remembered that the commutation characteristic of the various conductors depends on their position in the slots, those which are most embedded, and surrounded by other conductors which are at the same time electrically under the brush, having the most difficult commutation. The conductors at the side of the slot which first comes up to the brush have an easier characteristic than those which are commutated later in the slot, because the latter have mutual induction (between themselves and the conductors earlier in the slot, not yet emerged from under the brush) coming into their commutation equation, and tending to increase the reactance voltage of the later commutated coils. Thus if 1, 2 are at the top of the group, 3, 4 in the middle, and 5, 6 at the bottom, then if 1, 3, 5, which form a vertical side of the group, come first to the brush, the difficulty of commutation will probably increase as these various coils come under the brush, although the quantitative difference cannot be stated owing to lack of data. Coils normally arranged should therefore produce groups of commutator segments which will show increasing tendency to spark, these groups consisting of pairs, threes, or sixes, according to the number of segments per coil. If now the coils have got displaced, it is conceivable that the irregular group may combine with the adjacent normal group so as to upset the succession that two bad segments come together, which, coming under the brush together, might cause a distinctly increased tendency to spark at that point. This can only be generally stated owing to the lack of detail already indicated. Further, it is clear that all the six conductors are not exactly in phase, and if they are displaced so as to be unlike the coil at the opposite side of the armature (assuming a four-pole machine) which is being commutated at the same time, it is conceivable that there might be enough difference in phase between the two sides of the armature to cause a cross-current, which in the absence of equalisers might set up sparking.

Speaking generally, any lack of symmetry is bad in a lap-wound armature, and may set up irregularities which become cumulative in their effect, and result in flattening and sparking, but it must be candidly confessed that so slight an irregularity as the one described in the question, as here understood, does not seem as though it should be sufficient to cause serious trouble unless the motor is, to begin with, very sensitive as regards commutation, and ready to be upset by some small cause. If sparking does occur it can only be because of some such cause as has been generally indicated. If equalisers are fitted, then out-of-phase effects should not make themselves visible at the brushes, and the matter would then resolve itself into one of reactance voltage.

Possibly these notes, necessarily vague on account of lack of information, may help the questioner to solve any difficulty that may have arisen. It is a pity he has not even stated the voltage of the motor.

The second award (5s.) is made to "W. H." for the following reply, which is slightly abridged:

By reversing the positions of 1 and 2, 3 and 4, 5 and 6, it results in the coil connected to a particular segment being commutated in a slightly different position relatively to the corresponding coils in the other portions of the armature, providing there are more than two poles.

If there are only two poles the effect on the sparking will be negligible.

If there are more than two poles there will be some appreciable increase in sparking unless the machine is fitted with commutating poles. In this event the machine being only a small one, and consequently not being anywhere near the limit of reactance volts, the sparking would not be visibly increased, although slight blackening of the commutator may occur owing to under-brush sparking caused by circulating currents.

It is suggested that the relative positions of 3-4 and 5-6 have also been changed; this it is rather difficult to imagine may happen, as it means two badly wound coils with the conductors crossing, but in any case the result as regards sparking would be *nil*, as the position of the commutated coil relatively to the field is not altered.—W. H.

Obituary.—The death took place on Monday of Sir Arthur Rucker, F.R.S., late Principal of the University of London, at the age of 67.

EDISON ELECTRIC MOTOR LORRY

THE Manchester branch of Messrs. Drake & Gorham, Ltd. (47 Spring Gardens, Manchester), sends us some interesting particulars of a new 30-cwt. electric motor lorry by Edison Accumulators, Ltd., for whom they are agents in the North of England. The lorry, of which we give an illustration, is built on a chassis known as the Edison Accumulator Model "G. M." The transmission from motor to differential countershaft is noteworthy, being effected by special flat spring-tempered steel blade, flexible and self-aligning, fitted with bronze-bushed eyes working on hardened pins provided with grease-cups, and large square slip joint at motor end. Then from a jack-shaft to rear wheels the driving is by sprockets and roller chains.

The accumulator consists of 60 Edison cells, type "A," with a capacity of 225 amp.-hours at the five-hour discharge rate, the total weight being 1,260 lb. It is housed below and behind the driver's seat. The motor rating is 72 volts, 40 amps., 900 r.p.m. It is a motor of the enclosed type,



specially designed to have maximum efficiency with the accumulator characteristics. The commutator is slotted in a manner similar to the standard street railway type. The shaft is mounted on ball bearings.

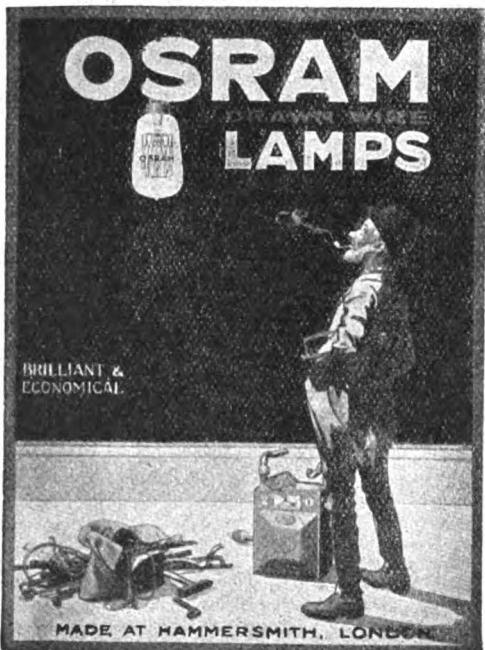
The controller is of the continuous torque drum type, and gives five speeds forward and two reverse. It is operated by handle above, and concentric with the steering-wheel. It is mounted on the front of the car under a rainproof hood, which also covers an ampere-hour meter, safety switch, light switches, and switchboard. The resistances are of the standard grid type.

The car operates over a radius of 40 to 50 miles per charge, at an average speed of 11 miles per hour when fully loaded, an extra 15 miles being possible by giving the accumulators one hour's boost at twice normal rate. The makers claim that the average power consumption of a lorry of this type recently delivered to the Blackpool Co-operative Society, is under 0·7 unit battery input per mile run, and as the Society generates current at about ½d. per unit, the power cost for a 20 miles' round trip is only 7d., compared with a fuel cost of 3s. 8d. for a petrol lorry that has been doing similar work for the Society. The fact that the Society has published a eulogistic notice of the vehicle in their official journal, and have placed an order for a second vehicle, certainly points to their satisfaction with the results obtained with the present one.

Germany's Shortage of Copper.—According to a Reuter telegram from Copenhagen, the Kiel municipality has ordered the breaking up of the tramways in some of the less busy parts of the town, the main object apparently being to obtain the copper from the cables. The work of demolition has been started in three streets, and already about 7 tons of copper have been obtained for war purposes. It is added that similar steps are anticipated in a number of other German cities.

OSRAM ART

THE latest design for advertising Osram drawn-wire lamps is exceedingly effective. Our reproduction of it in black and white does poor justice to the original, which is strikingly coloured. The expansive rich blue background and the stone colour foreground make a very charming setting. The attitude, features, and colouring of the "gas-fitter," together with the



humour of the design, produce a general effect which is both impelling and pleasing.

Posters and showcards, lithographed in ten colours, will shortly be available, and in a few days' time a small folder and a quarto size four-page list of Osram drawn-wire lamps will be ready for distribution. In these two cases the design is printed in four colours on the outside front page.

CATALOGUES, PAMPHLETS, &c., RECEIVED

"WRENDAL" METAL FILAMENT LAMPS.—A leaflet from L. Andrew & Co. (2 Whitworth Street West, Deansgate, Manchester), gives particulars and prices of "Wrendal" British-made lamp and "Capella" carbon filament lamp. The consumption of either the low or high voltage types of the metal filament lamp is quoted at 1½ watts per British c.p., with an average life of 2,000 hours, whilst for the carbon lamp the consumption is given at 3½ watts per c.p., and the life 1,000 hours for low voltage and 700 hours for high voltage.

EDISWAN ACCESSORIES AND FITTINGS.—A 10-page leaflet from the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), deals with every detail in electric light accessories and fittings which go to make up the complete article.

OSRAM PAINTING BOOKS.—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), has tapped a really novel source of interest in a series of children's painting books. Three of these have been issued containing on the left-hand pages a coloured drawing and on the corresponding right-hand pages the same drawing in detail. The pictures illustrate rhymes which, in simple fashion, sing the virtues of Osram lamps. The first deals with the lights of 1830, 1890, and 1915, viz., the candle, gas, and the Osram lamp respectively. The second deals with the story of how an Eskimo girl discovered what she perversely mistook for the sun, and the third relates how the lesser light which rules the night has been forgotten by children who live in cities lighted by Osram lamps. The drawings have a quaintness which will appeal to the children—and, be it said, to the parents also—and should result in giving a happy impression of the Osram lamp. These painting books are being distributed direct among electric light consumers, and have already proved very popular. This is a scheme from head office to supplement local advertising through contractors.

MAGNET FIRES, COOKERS, IRONS, &c.—Folders from the General Electric Co. Ltd. (67 Queen Victoria Street, E.C.), give particulars of the Company's electric fires, cookers, irons, kettles, toasters, and hot plates. These will be supplied to electrical contractors, over-printed with their name, on application to the Company.

"WOTAN" DESK PAD.—We have received from Messrs. Siemens Bros. Dynamo Works, Ltd. (38 and 39 Upper Thames Street, E.C.) an exceedingly useful Wotan desk pad. This is made of oxidised metal, and is provided with a spring clip so that the separate sheets of the writing pad itself can be readily removed or replaced as occasion requires.

TENDERS INVITED AND PROSPECTIVE BUSINESS**Generating Stations, Sub-Stations, Mains, &c.**

Erith.—Three 100-k.v.a. transformers and switch panels are required.

Gloucester.—Application is to be made for a loan of £25,000 for plant extensions to meet the demand for power from the Gloucester Paper Mills.

Ipswich.—An inquiry was held last week concerning a loan of £3,100 for coal bunkers and coal-handling plant at the electricity works.

Middlesbrough.—It is proposed to instal an automatic regulator at the electricity works and to carry out certain alterations to the cables for taking the entire supply from the Cleveland & Durham Electric Power Co. This scheme substitutes one put forward a short time ago for the installation of a large booster.

New Zealand.—The Napier Council requires two gas engines with generators, switchboard panels, cables, &c. Tenders to Clerk. November 9th. This information, of course, is only of value to firms who can cable agents.

Sheffield.—Coal-handling plant is to be installed at Neepsend at an estimated cost of £6,000.

Stoke-on-Trent.—Application is to be made for a loan of £1,000 to cover prospective expenditure on distributors, &c., during the next six months.

Wolverhampton.—A loan of £1,365 has been sanctioned for mains extensions to deal with firms engaged on war work.

Wiring

Barrow-in-Furness.—Victoria Schools, Oxford Street. Borough Electrical Engineer. November 8th.

Latchford (Cheshire).—Electric lighting for St. James's Church. Rev. H. B. Firth, Vicar.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Cardiff.—New public hall. Architects, Willmott & Smith, 29 St. Mary Street.

Coventry.—Extensions to factory, Gosford Street, for Messrs. Hotchkiss.

Rochdale.—Military hospital.

Miscellaneous

London: H.M. Office of Works.—Supply of electric lamp-holders. Controller of Supplies, 18 Queen Anne's Gate, S.W. November 8th.

APPOINTMENTS AND PERSONAL NOTES

The Pembroke (Ireland) Council requires a temporary shift engineer acquainted with a three-wire D.C. station. Applications to Clerk. November 5th.

An electrician is required for Gold Coast Government Waterworks. Salary £300, rising to £350. The plant consists of a 500-volt suction gas generating set with electric motors. Applications to Messrs. Hunter, Duff & Middleton, 17 Victoria Street, S.W.

The salary of Mr. J. R. Hall, Mains Superintendent at Accrington, has been increased from £140 to £146 10s.

The Southern Command of the War Department requires various electrical workmen. (See an advertisement on another page.)

Arrangements for the Week.—**Friday, Nov. 5th.** University College, London. Lecture II. "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S. 5 p.m.

Monday, Nov. 8th. Newcastle Section, I.E.E. Mining Institute. Chairman's Address by P. V. Hunter. 7.30 p.m.

Tuesday, Nov. 9th. Scottish Section I.E.E., 207 Bath Street, Glasgow. Chairman's Address by D. A. Starr. 8 p.m.

Thursday, Nov. 11th. Yorkshire Section I.E.E., Philosophical Hall, Leeds. Chairman's Address by H. H. Wright. 7 p.m.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £89 to £90 (last week, £87 10s. to £88 10s.).

Bankruptcy.—The last day for receiving proofs in the bankruptcy of Herbert Page, electrical engineer, trading as Smeeton & Page, 63 Queen Victoria Street, is November 6th. The trustee is the Official Receiver, Bankruptcy Buildings, Carey Street, W.C.

Liquidation.—A compulsory winding-up order has been made with regard to the Adnil Electric Co. The position of this Company was discussed in the action by the British Traders' Association, reported on p. 246 of our issue for June 10th.

Agencies.—A Montreal firm wishes to represent United Kingdom manufacturers of electrical equipment for the mining industry.—A firm in Viborg (Russia) wishes to get into touch with United Kingdom manufacturers and exporters of electrical plant, fittings, and machinery. Further particulars at 73 Basinghall Street, E.C.

LOCAL NOTES

Birmingham: Temporary Power Station.—It is anticipated that the temporary power station which was described in our issue for August 19th, p. 346, will be completed in about three weeks' time. Pending this, the Electric Supply Committee ask all consumers to use as little current as possible between 5 and 6 p.m.

Bradford: Inauguration of New Plant.—Some of the new plant mentioned in our account of the Bradford Electricity Department on p. 434 of our last issue, was started up on Thursday. This consisted of a 5,000-kw. turbo-generator and two 1,500-kw. rotary converters at the Valley Road power-house. A third rotary converter set is to be installed. At the subsequent luncheon some reference was made to the contract placed for a Bergmann turbo-generator which caused so much controversy at the time it was made. The Chairman of the Electricity Committee recalled the fact that the steam consumption figures for this German turbo-alternator were 10 per cent. less than the best English tender, and added that it had been determined to keep the Germans rigidly to their contract. Mr. T. Roles, the City Electrical Engineer, was actually in London on his way to Germany when war broke out. The substituted contract was secured by the British Westinghouse Co., who, he thought, had carried it out very successfully. The cost of the scheme had been about £80,000. Reference was also made to two interesting additions to the connections. One is for 1,000 kw. per 24 hours all the year round for electric furnace work, whilst the Dumb Mills, in which over 25,000 spindles are to be installed, are to be run electrically off the Corporation mains.

Londonderry: Municipal Wiring.—The Corporation has asked the Belfast Corporation to adopt a resolution petitioning the Government to bring in a Bill authorising municipalities to undertake the electric wiring of premises. The Belfast Electricity Committee, however, do not propose to take any action in the matter. Why this matter should be raised seriously at the present moment is not quite clear. Obviously action either by the Government or the I.M.E.A. is impossible.

Oldham: Supply from Trolley Wires.—The ordinary supply mains in the Hollins district being already fully loaded, the Tramways Committee has agreed to supply a new power user in that district from the trolley wires.

South Africa: Shortage of Electrical Accessories.—The Natal Mercury reports that there is a notable local shortage in Johannesburg of high candle-power lamps, flexible wire, and electro-medical apparatus. It is also stated that half-watt lamps are unobtainable.

Wolverhampton: Loan Refused.—The L.G.B. has informed the Corporation that it is not prepared to sanction a loan of £5,000 to defray expenditure on ordinary extensions of mains. A loan, however, has been granted for giving a supply to certain firms engaged on war work.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Adelaide Electric Supply Co.—A resolution has been passed authorising an increase in the capital by a further 50,000 £5 shares.

Holophane.—An application will come before Mr. Justice Astbury on Saturday for the reduction of the capital of this Company from £200,000 to £105,000.

South Metropolitan Electric Light & Power Co.—A proposal has been put before the debenture holders to vary the trust deeds as regards the amount to be set aside to reserve or depreciation. At present the Company is bound to set aside a sum equal to 2½ per cent. of its share and loan capital, but it is suggested that this should be reduced to 1½ per cent. under certain conditions. The object, it is stated, is to enable a dividend to be declared on the ordinary shares at an early date. No dividend on these shares has been distributed since 1908, although the amount available last year would have enabled a dividend to be paid if some such variation as that now proposed could be offered. According to the *Financial Times* the debenture holders are objecting, and the requisite three-fourths majority in favour was not obtained at a meeting of the debenture holders last week. It was stated that the trustees hold sufficient proxies to prevent the scheme being carried if a poll is demanded.

The Institution.—The opening meeting of the session of the Institution of Electrical Engineers has again been postponed. Mr. C. P. Sparks will deliver his Presidential Address on Thursday, Nov. 18th.

The National Illumination Committee.—A meeting of the National Illumination Committee of Great Britain was held at the Institution of Electrical Engineers on Oct. 20th, 1915, when it was reported that Mr. Jacques Abady had been nominated by the Institution of Gas Engineers as a member of the Committee to fill the vacancy caused by the death of Mr. Edward Allen. The Committee elected Mr. W. Duddell, of London, to be chairman in succession to the late Mr. Allen, and Mr. John Bond, of Southport, to succeed Mr. Duddell as one of the vice-chairmen. Reports on observations carried out, at the instance of the Committee, at a number of technical laboratories, on the height to which the flame of the Hefner amyl acetate lamp should be raised to afford a light on one International or English standard candle, were discussed, and their further consideration was postponed. A report by Dr. E. Ott, of Zurich, on researches carried out in Switzerland on the effect of atmospheric pressure, humidity and vitiation on the light afforded by the Hefner standard lamp was considered, and it was decided to prepare a translation of the report for communication to the English technical press.

Westinghouse Lantern Slides.—The British Westinghouse Co. (Trafford Park, Manchester), call attention to the large and varied selection of lantern slides which they have. These are freely loaned to responsible persons, and the lecture season having now commenced, some of our readers will probably welcome this offer by the Company.

A Shooting Contest.—A friendly match between teams representing the British Electric Transformer Co. and the Ediswan Rifle Club, which took place by arrangement with the former club at Hayes, Middlesex, last Saturday afternoon, resulted in a win for the British Electric Transformer Co. by 554 to 541 points. The visitors were kindly entertained to tea after the match.

Centralisation of Supply in Scotland.—In his Presidential Address to the Institution of Engineers and Shipbuilders in Scotland on Tuesday last week, Mr. W. W. Lackie, the Glasgow City Electrical Engineer, made some interesting remarks with regard to the size of power stations and the possibility of dividing Scotland into areas for electric supply purposes. At present there are thirty-one electricity supply undertakings in Scotland, with a total capacity of about 120,000 kw. It would be possible, however, said Mr. Lackie, to divide Scotland into three areas for the purpose of electric supply, of which the lowlands south of the River Tay would represent two areas, and the whole of Scotland to the north of the Tay the third. Taking Falkirk as the boundary between the two first-named areas, the demand in the western area amounted to 80,000 kw., and that in the eastern area to 25,000 kw. From this, he said, three moderate-sized stations would meet the entire demands of Scotland.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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SUMMARY

MR. S. E. FEDDEN, General Manager and Engineer of the Sheffield Electricity Supply Department, recently took the unprecedented course of placing orders for £120,000 worth of machinery upon his own responsibility (p. 452).

A REPLY is given to Mr. Nichol Moore's letter last week on the effect of enlistment upon electricity works (p. 452).

HEYWOOD (Lancs.) now uses bulk supply from Bury for its extensions. Overhead transmission at 6,300 volts is used, and an interesting feature of the plant is the automatic battery regulation (p. 453).

THE prospects for electrical trade with China are referred to (p. 453).

OUR Questions and Answers Columns deal with an adjustable resistance for occasional testing purposes (p. 455).

AMONG the subjects of specifications published by the Patent Office last Thursday are controllers, telephone transmission switches and wiring accessories. A wireless telegraph patent is opposed, and the grant of a microphone patent has been refused. Patents for a telegraph perforator and an insulating compound for core plates expire this week after a full life (p. 456).

WE outline proposals by the Electrical Contractors' Association for dealing with the position which has arisen in connection with the Board of Trade objections to the Guaranteed Wiring Scheme (p. 456).

A DESCRIPTION of a picture-lighting fitting is given (p. 457).

THE Minister of Munitions points out that employees of electrical undertakings are essential to the proper supply of munitions of war, and should remain at their posts (p. 457).

NEW generating plant is required at Luton (£25,650); turbo-alternator and induced draught plant at Manchester; services and meters at Belfast; boiler plant at West Hartlepool; cable and switchgear at Hackney (p. 458).

AN alteration is to be made in the arrangements between the St. Marylebone Electricity Department and the local wiring contractors (p. 458).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDANT.

Drills: 6.25 to 7.25; 7.25 to 8.25.

(To-day) Thurs., Nov. 11th: Sec. III., technical. Sec. I., shooting or working party.

Fri., Nov. 12th: Sec. IV., technical. Sec. II., squad or working party.

Mon., Nov. 15th: Sections I and II., technical. Sections III. and IV., squad or working party. Recruits and signalling section.

Tues., Nov. 16th: School of Arms with Architects Corps, 6.0 to 8.0 p.m.

Thurs., Nov. 18th: Sections III. and IV., signalling section, shooting.

Fri., Nov. 19th: Sections III. and IV., technical. Sections I. and II., squad or working party. Signalling section and recruits.

Sat., Nov. 20th: Uniform parade, 3 p.m.

Sections for technical parade at Headquarters, London Electrical Engineers, 46 Regency Street.

Sections for shooting parade at the miniature ranges.

Unless otherwise ordered, all parades at Chester House.

Until further orders, Sections I. and II. will parade on Mondays for technical, and on Fridays for squad drill, and Sections III. and IV. will parade on Mondays for squad drill and Fridays for technical, but Sections I. and II., and III. and IV. will alternate weekly for shooting on Thursdays.

Signalling Section will shoot on the same days as Sections I. and II.

Arrangements for the Week.—(To-day) Thursday, Nov. 11th. Yorkshire Section, I.E.E. Hotel Metropole, Leeds. Chairman's Address by H. H. Wright. Smoking concert, 7 p.m.

Friday, Nov. 12th. Physical Society. Imperial College of Science, S. Kensington. "The Effect of Electric Oscillations on the Magnetic Properties of Iron, investigated by the Campograph," by Prof. J. A. Fleming. 5 p.m.

Tuesday, Nov. 16th. Manchester Section I.E.E. Engineers' Club, Albert Square. Chairman's Address, by B. Welbourn. 7.30 p.m.

Thursday, Nov. 18th. Institution of Electrical Engineers. Presidential Address by C. P. Sparks. The premiums for last session will be presented. 8 p.m.

Excess Profits Tax.—We understand that the Chancellor of the Exchequer recently received a deputation representing an important and influential group of London and provincial electric supply undertakings with regard to the position of companies existing under statutory limitations, in the matter of taxation of excess profits. The Chancellor stated in reply to a question in the House of Commons a short time ago that the question of the adequacy of the 6 per cent. rate of return in respect of such companies would be a matter for consideration by the Board of Referees under Clause 38 of the Finance Bill.

£120,000 PLANT ORDERED IN ADVANCE OF LIGHTING COMMITTEE'S SANCTION

An example of how to do things, notwithstanding the hide-bound regulations under which municipalities have to work at the present moment, particularly in the matter of capital expenditure, has been provided at Sheffield. We pointed out on p. 391 of our issue of September 23rd that a scheme of extensions estimated to cost £100,000 had been prepared, and that the Ministry of Munitions had given its consent, together with its undertaking to make some arrangements whereby, at the close of the war, the plant should, if necessary, be taken off the hands of the Corporation. Meanwhile the urgency of the demands upon the undertaking had reached such a point that Mr. S. E. Fedden, General Manager and Engineer of the Corporation electricity undertaking, took a course which few other central station engineers would have risked: he just ordered on his own responsibility plant costing £120,000.

Those who know Mr. Fedden best realise full well that this is precisely what he would do when faced by a situation of this sort, and the fact that his Electricity Committee has absolved him in the matter stamps the members as progressive as their engineer. The record of the Sheffield electricity undertaking, particularly in the direction of power supply, is sufficient commentary upon the efficiency of its management, and although Mr. Fedden's action will probably make some of our more old-fashioned public officials and councillors rub their eyes, nevertheless those central station engineers who regard the necessities of their undertakings as of more importance than the strict adherence to regulations, which even in times of peace are a source of great irritation to practical men, will admire Mr. Fedden for giving them a lead which may come in useful to themselves some time or other. In addition to the £120,000 mentioned, the Emergency Committee of the Electricity Committee has sanctioned, without waiting for the full Committee's approval, various other items of expenditure, aggregating some £10,000, particularly in increasing the coal-handling plant and storage at Neepsend.

Locally, of course, there has been much satisfaction at what has been done, although some regret is expressed at the policy of the Department in continuing in force pre-war charges notwithstanding the enhanced prices for coal and labour, and also the fact that many of the works which are being supplied at very low rates for power are making considerable war profits. This, however, is more or less a domestic matter with which we are not concerned at the moment. We will content ourselves with congratulating Mr. Fedden upon his businesslike grip of a situation which, had it been allowed to run the normal course of officialism, might have resulted in manufacturers engaged on Government work being seriously handicapped through shortage of power supply.

CORRESPONDENCE

THE EFFECT OF ENLISTMENT AND MUNITION WORKING ON ELECTRICAL UNDERTAKINGS.

To the Editor of ELECTRICAL ENGINEERING.

SIR.—Mr. Nichols Moore's letter in your current issue is very welcome. He does not agree with all the ideas I put forward, and that is why I am glad to see his contribution.

Mr. Moore has dealt with his problems in accordance with his local circumstances: we have done the same, and I can assure him that our problems in the matter are much stiffer than is the case at Newport. One large town adjoins another in our part of the country, and there are literally square miles of munition works, all crying for men..

When a man can make over £2 a week more than we could give him the opportunity to make, then a six weeks' holiday with a sure job at the end thereof has its attractions.

We did not *make* work in order to give our men overtime, and if Mr. Moore refers to the article he will see that it is distinctly stated that they were put on to jobs which had been side-tracked owing to our usual complement of men having been depleted by enlistment. These are jobs which would have had to be tackled sooner or later, and one such job is already saving us a fair amount in the handling of our coal. We are paying more for the work, but even then it is cheaper than letting our men, who know every nook and cranny of the place, go. They realised that they would get no more advances, and naturally were inclined to take up the idea of playing for six weeks. The overtime gives them some extra money, which, though not what they might earn, keeps them with us, as they feel that the plant is doing something for them, and they have no need to turn out to another shop. The junior assistants have been prevented

from leaving simply because other chief engineers besides Mr. Moore have adopted the plan of not taking them without their present chief's consent. I have been repeating the "patting on the back" process every day since the article was written, and, in fact, have more reason to be thankful for our policy almost every day that passes.

When the policy was adopted it was done after having considered *all conditions* under which we were then working, and had there been financial danger and no reserve fund, things might have been a good deal different; but again circumstances alter cases, and, moreover, the plant we retained is not of the old crock variety, but is good plant having a very decent economy and being extremely reliable. Many important works depend on us for their power, and these older plants have helped us out of many a tight corner.

The connection between munition making, electricity works, and the international situation is so plain that I am surprised at Mr. Moore stating he is unable to see the connection. This attitude is, unhappily, characteristically British, and has accounted for our failure to meet the Hun in commerce to a greater extent than is generally realised. Unless we alter our tactics we shall suffer again after the war.

I do not know how much extra plant Mr. Moore is installing, and will be compelled to instal in order to cope with the munition works load, but I do know that we are in for heavy capital commitments on that account.

After the war, when the munition stocks are properly replenished, there will be a very bad slump in trade, unless steps are taken to prevent it. This slump in trade will throw thousands of machine tools idle, and, in consequence, the factories will not require much power for a considerable time. We shall then be in the position of having large plants in our stations which will hardly run sufficiently to earn their upkeep and maintenance charges, let alone any return on the investment.

To prevent such a calamity international measures are necessary. The measures which in my opinion might suffice, and the reasons which make them necessary—well, are they not written in the original article which appeared in October, even on the seventh day of that month?

There was another good reason for my dissertation on international questions. The Editor asked me to state my opinion on the probable situation after the war, and the manner in which that situation would affect electricity works.

I conclude with thanks to Mr. Moore for his letter.

Yours faithfully,

THE WRITER OF THE ARTICLE.

Nov. 6th, 1915.

BRITISH ELECTRICAL TRADE WITH RUSSIA.

To the Editor of ELECTRICAL ENGINEERING.

SIR.—We have the honour to ask you to note that this Company, who are concessionnaires of the electric lighting stations in Pawlowsk, Uman, Kameuetz, and Podolsk, and of tramways in Elizabethgrad and Uman, have opened a branch for the sale of electrical machines and apparatus, insulating materials, steam and naphtha engines and water-turbines, and desire to enter into relations with first-class factories in your country producing these goods with the view of becoming their agents in Russia.

At the same time we have the honour of informing you that as our Company belongs to the Russian and French Bank, we are able to offer for all our engagements the complete guarantee of this Bank.

We remain, yours faithfully,

RUSSIAN SOCIETY FOR ELECTRICAL ENTERPRISES, LTD.
Petrograd, 5 Marsowo Polje, Oct. 25th, 1915.

Thirty Volts would not have Killed Him.—What the coroner called a stupid device caused the death of an assistant in a restaurant at Neath (S. Wales) last week. The proprietor of the restaurant, an Italian, had connected a brass rail running along his counter with the supply main, and at the same time had had a metal plate let into the floor along the front of the counter. Obviously anyone standing on the plate and touching the hand-rail would receive a shock, and it so happened that one of his assistants did this, and being, according to the medical evidence, in a low state of health, and suffering from heart disease, the shock was fatal. The restaurant keeper explained at the inquest that he had put in the device in order to prevent boys from stealing off the counter. An electrical engineer who gave evidence, stated that the supply voltage was 220-volts, but 30 volts was the maximum he had been able to obtain by a test at the spot where the deceased man received his fatal shock. The coroner censured the proprietor, and the jury added a rider to their verdict that the Corporation should have any similar device, if such exists in the town, done away with.

BULK SUPPLY EXTENSIONS AT HEYWOOD

HEYWOOD, a Lancashire town of 27,000 inhabitants, about $3\frac{1}{2}$ miles from Bury, has 617 kw. of lamp connections and 400 kw. of motor connections, and a load factor

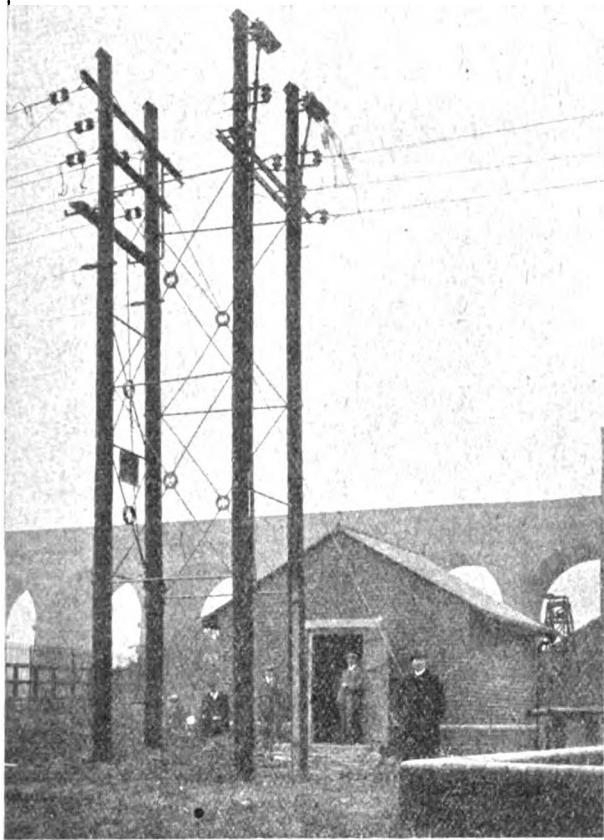


FIG. 1.—TERMINAL POLES AND METERING STATION.

of 22·6 per cent. Its costs per unit sold last year, including all charges except interest and sinking fund, were 1·07d. per

bulk supply from Bury for all future extensions, and the first instalment of these was formally opened on October 30th.

The transmission line from Bury to Heywood is overhead except for two short lengths of underground cable at each end. A view of the metering station and terminal pole-line arrangement is shown in Fig. 1. The E.H.T. cables would, in the ordinary course, have been in duplicate, but at the request of the Local Government Board only one line has been erected at present, and a second one will be put up later. Current is received at 6,300 volts, three-phase, 50 cycles, and converted to D.C. by means of a static transformer and rotary converter, the capacity of the converting plant being 600 kw. Fig. 2 is a complete view of the new plant, and Fig. 3 shows the Westinghouse E.H.T. switchgear to a larger scale. The rotary converter is also Westinghouse, is fitted with a booster, and has inter and compensating poles and the Westinghouse patent self-synchronising method of starting. A feature of this machine is that it has only two bearings.

A Tudor battery with a capacity of 840 ampere-hours at the 10-hour discharge rate (220 amperes for three hours, 280 for two hours, and 440 for one hour) has been put in, and an interesting Bertram Thomas automatic regulating switch is used in conjunction with it, which, besides regulating the voltage automatically, has the additional advantage of saving long leads for regulating cells. A pair of these automatic switches are used, one for the positive and one for the negative cells, on either side of the three-wire system.

Each switch consists of two parts: a regulating switch carrying the main current, and a voltage regulator or governor controlling the operation of the regulating switch. In the arrangement at Heywood the battery contacts on the former are arranged in a circle, and there are two moving contact arms, one for charge and one for discharge, moving over the same cell contacts, but making connection with two independent ring contacts. The discharging arm only is made for automatic operation, and the charging contact arm is moved by hand. The discharging arm is moved by the operation of two solenoids, one for cutting in cells and the other for cutting out. The solenoid cores engage with the contact arm through a system of pawls and toothed wheels, so constructed that one stroke of the solenoid carries the contact arm accurately from the centre of one contact to the centre of the next, and the pawls and wheels are so shaped and locked that there is no possibility of overshooting. At the top of the stroke of the solenoid the supply of current to it is automatically interrupted on carbon contacts

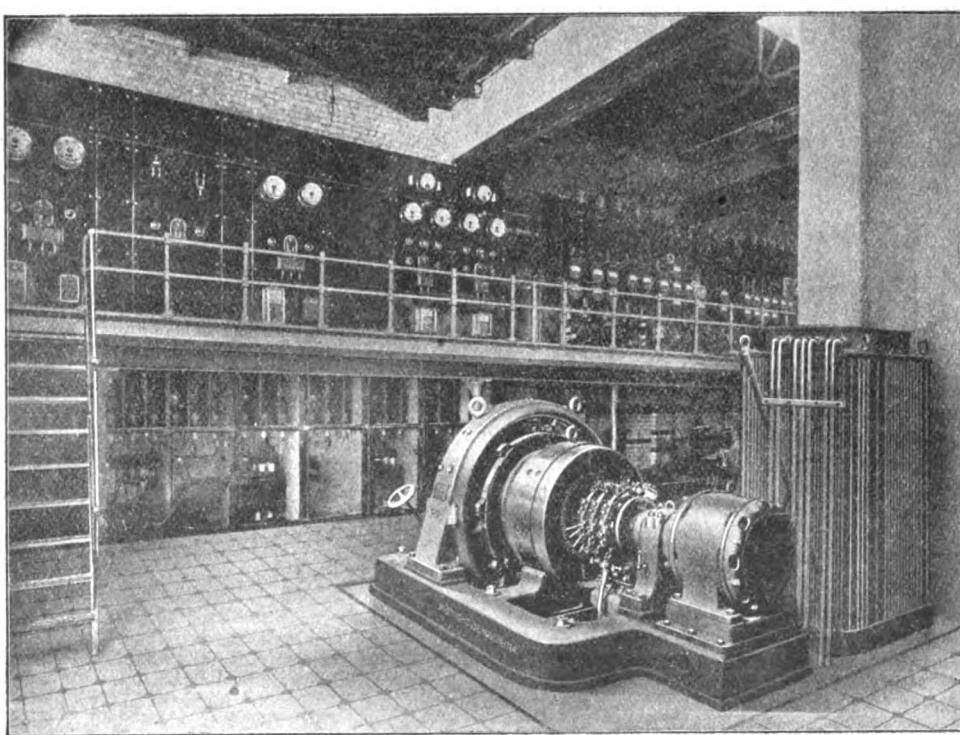


FIG. 2.—THE NEW PLANT.

unit. On the advice of the Borough Electrical Engineer and Tramways Manager, Mr. R. B. Leach, it was decided to take

in a magnetic field, and this contact is re-established under the control of a dashpot with variable time element, enabling the

interval between the strokes to be regulated as desired. Thus the controlling governor is called upon to make contact only, and the sparking at the governor contact points is practically nil.

The main regulating switch is also provided with limit switches which come into operation at each end of the range of the contact arm, and prevent the contact arm from being driven past the last contact. The main contact arms are each provided with a pilot brush and resistance for preventing short circuit of adjacent cells at the moment of change.

The governor is a moving arm making contact either at the top or bottom of its range, and controlled by a powerful solenoid wound with fine wire, and connected across the bus-bars. Normally the contact-arm floats evenly between the two contact blocks.

In order to ensure the supply of current to the operating solenoid of the regulating switch over such a period as is required to complete the stroke, "accentuating coils," on much the same principle as retaining coils of telephone relays, are fitted to the governor in such a way that immediately the contact points touch and current passes, a small auxiliary magnet is energised which attracts a flexible iron armature on the moving contact arm, and thereby exerts a pressure between the contact faces until such time as the current is cut off at the contacts on the main regulating switch.

ELECTRICAL TRADE IN CHINA

M R. W. G. L. RIDDELL, President of the Birmingham & District Electric Club, has returned from a 12-months' tour in China, and a dinner was given him last week by the members. In our last issue, p. 434, we published an interview with Mr. T. W. Ainscough, the Board of Trade Special Commissioner, who has also just returned from China, and Mr. Riddle's remarks on the question of trade in China formed a useful supplement to the information given in our article last week. After a reference to the considerable success of the Shanghai electrical undertaking, where current is being supplied for power purposes at as low as £2 10s. per kw. per annum, plus 4d. per unit, Mr. Riddle drew attention to the keenness which the Chinese are showing in the possibilities of electric driving. One reason, he thought, for this was the absence of any form of administrative control which tended to discourage enterprise. There was in China, he said, no Board of Trade or Local Government Board to perform this function. Nevertheless, he thought the electric supply industry in China would benefit by regulations to ensure a reasonable degree of safety. Any

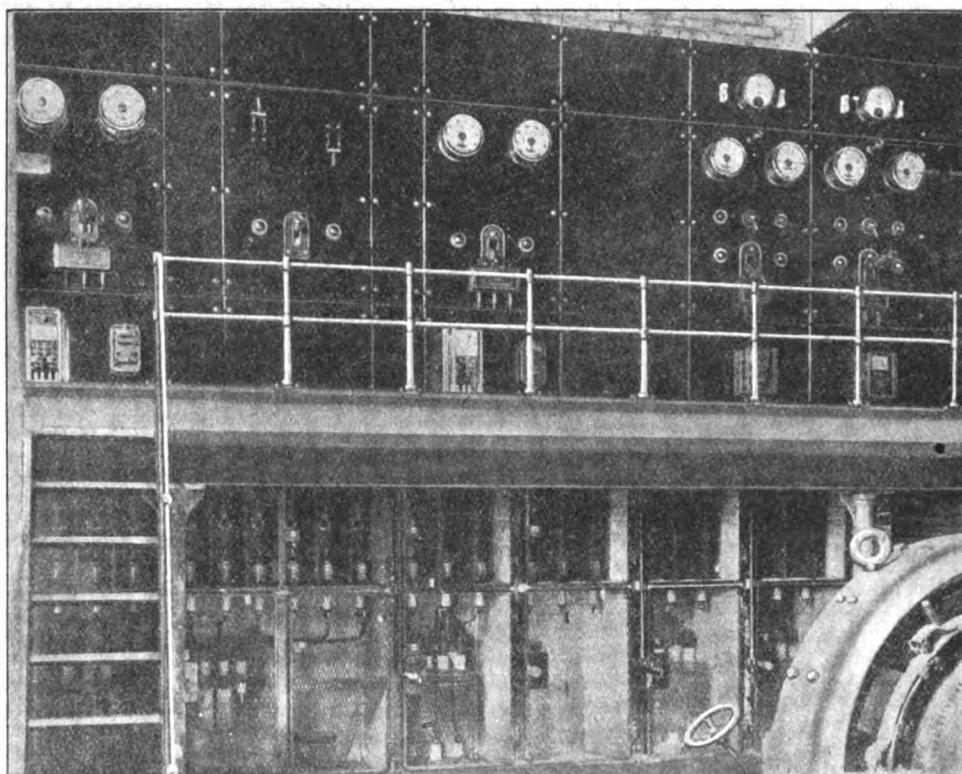


FIG. 3.—E.H.T. SWITCHBOARD.

An electrically operated indicator completes the equipment. This is fixed on the switchboard, and shows the number of cells in circuit at any given moment.

Special change-over switches have also been fitted in circuit with the battery boosters. In the event of the breaker of a booster motor tripping, the booster is automatically cut out, leaving the battery floating on the bus-bars; and if the discharge becomes so great that the boosters are overloaded, the switches clear the booster armatures, again leaving the battery floating.

We are indebted to Mr. Leach for much of the information contained in this article and the loan of the blocks, and to Mr. Bertram Thomas for details of his ingenious automatic switchgear.

Municipal Wiring.—The report of the Ironmongers' Federated Association for the year just completed, in calling attention to municipal trading, states that the Electrical Committee of the Glasgow Corporation has made as fair and equitable arrangements with the trades affected as could be expected. We gave particulars of the arrangements between the Glasgow Corporation and the Glasgow electrical contractors in our issue for March 25th, p. 128. At the same time the report adds that members should closely watch the encroachment on their trade by municipalities and urban district councils and advise headquarters of any new departure in this direction which comes to their notice.

review of the position of trade in China seems to be out of place without some reference to the favourable terms offered by Continental firms, and Mr. Riddle mentioned the case of a 10,000 spindle electrically-driven cotton mill which was built and equipped without any expenditure by the owners, the arrangements being that its cost was to be met by the surplus revenue after payment of a minimum dividend. Since the outbreak of war neither Britain nor Germany had been able to take contracts, but he believed that Germany would be in the field with renewed vigour when the war was over. At the present time America and Japan were securing the bulk of the trade.

Killed in Action.—The County of London Electric Supply Company, which has already lost a number of its employees in the war, has sustained further losses of this character. Private G. W. R. Peek, of the 6th Battalion, Duke of Cornwall's Light Infantry, who was previously a motor inspector in the Mains Department, was wounded in France on October 9th in the attack near Hulluch, and subsequently died of the wounds on October 12th. Corp. Sydney A. Wood, of the Machine Gun Section, "B" Company, Norfolk Regiment, who was also previously employed in the Mains Department, was killed in action on October 9th near La Bassée, and another employee in the same department, Private E. Gordon Morley, of the Queen's Westminsters, was killed in action on October 12th.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,468.

I have a D.C. motor rated at 20 h.p., 950 r.p.m., which drives some line shafting for machine tools. It is a 220-volt, 4-pole, shunt machine, with lap-wound armature, and has good commutation. I wish to increase the normal speed to 1,100 r.p.m. for special work during the war, and then to reduce it again to its normal value. What is the most economical way of doing this?

(Replies must be received not later than first post,
Thursday, Nov. 18th.)

ANSWERS TO No. 1,468.

It is desired to make up an adjustable resistance for occasional testing purposes in a small works, to give a voltage drop of 100 with a current of 5 amps. Describe a cheap method of doing this; state the material used, and the approximate cost of the resistance.

The first award (10s.) is given to "L. R." for the following reply:

The best resistance to use depends to a large extent on the exact purposes for which it is required, whether it is to be constant over a certain range of temperature or not, its capacity for variation, its permissible temperature rise, and so on.

The cheapest depends to some degree on what materials are available. A suitable resistance could be made from plain iron wire, from any of the modern high-resistance materials, or a liquid resistance could be schemed. Probably the middle class of the three will be the most satisfactory, but for accurate work some of the more expensive forms, such as manganin or platinoid, may be necessary. In these circumstances I have calculated the following table covering most of the usual resistance materials, basing it on a wire to carry 5 amperes with a drop of 100 volts.

In the case of eureka, platinoid, and manganin I have allowed for a small temperature rise only—that is, for the wire to be heated to blood-heat.

In the case of the other materials I have allowed for a temperature rise of 100° C. This should be permissible for ordinary resistances, but it may be undesirable to exceed this because of certain disadvantages, including the fact that fuses in the circuit may have to be altered because of the possible high current flow at starting.

| Material. | Size S.W.G. | Weight in lbs. | Length in vds. | Price per lb. | Cost. |
|---------------|----------------|-------------------|-------------------|------------------|-------|
| Eureka | ... 14 | 1·12 | 150 | 3/- | 3/4 |
| Manganin | ... 16 | 3·95 | 106 | 4/8 | 18/4 |
| Platinoid | ... 16 | 4·15 | 110 | 3/- | 12/6 |
| Chronic | ... 15 | 2·82 | 59 | 6/- | 17/- |
| Ferrozoid | ... 14 | 5 | 50 | 2/- | 10/- |
| Ferry | ... 17 | 2·12 | 73 | 2/5 | 5/2 |
| Tarnac | ... 18 | 1·32 | 62 | 3/1 | 4/1 |
| German silver | ... 17 | 2·5 | 87 | 2/- | 5/- |
| Zodiac | ... 17 | 1·68 | 58 | 2/- | 3/4 |
| Cupro I. | ... 18 | 2·04 | 97 | 1/9 | 3/7 |
| Cupro II. | ... 19 | 1·28 | 87 | 1/8 | 2/2 |
| Beacon | ... 16 | 1·53 | 47 | 3/8 | 5/7 |

The cheapest of these for the present case is therefore Cupro No. II., but it does not follow that the exact sizes

mentioned are necessarily in stock. Thus in that case the present list gives the largest size as No. 20 instead of No. 19. The difference is practically nil, as it only means that the wire will work at a temperature a few degrees above 100° C. On the other hand, large changes of temperature make a considerable difference in the cost. Take, for instance, Ferry. If this can be worked at 200° C., a No. 19 wire will suffice, the weight required being 0·56 lb., which at 2s. 5d. per lb. costs 1s. 4d. On the other hand, at 800° C. a No. 21 wire will suffice, 0·22 lb. at 2s. 6d. being required, costing 7d.

For Cupro No. II. at 200° C. 0·28 lb. of No. 22 at 1s. 8d. (cost 6d.) is necessary, and for 800° C. 0·08 lb. of No. 25 at 1s. 11d. (cost 2d.).

If a plain iron wire be used, about No. 17 would be required, and of this 5·7 lb. at 1s. a lb. (5s. 8d.) would be necessary.

In the case of a liquid resistance, a vessel about 12 in. in diameter and 4 ft. high should be provided, and the liquid composed of a solution of soda in water, 1lb. to $\frac{1}{2}$ lb. of soda per gallon being sufficient. The cost of this liquid is clearly nominal.

The way the resistance is mounted depends on what materials are handy. Thus an old motor-starter plate could be connected up to sections for cutting out the resistance step by step, and if this sub-division be not fine enough, a length of wire approximately equal to the length of one of the sections should be connected at one end to the starter arm or end stop, with a contact finger movable along it.

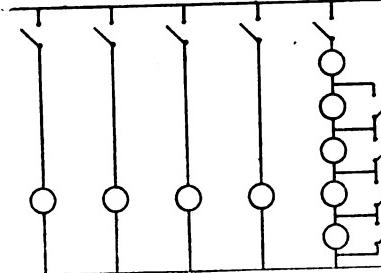
Again, in the case of the shorter lengths of wire, the wire can be wound on a rotating drum with fixed contact pointer, but it may be pointed out "Beacon" should not be wound on asbestos.

For a liquid resistance, if a vertical jar be used, the top electrode should be counterbalanced; but if the resistance be made in the form of a trough, clearly this is unnecessary.

The second award (5s.) is made to "J. G. M." for the following reply:

A simple and inexpensive resistance can be made with carbon filament lamps. An ordinary carbon lamp absorbs roughly four watts per c.p., so that a 25-c.p. 100-volt lamp will pass approximately one ampere. If, therefore, five of these lamps are connected in parallel and each controlled by a switch, a very efficient rheostat is obtained which will drop 100 volts at currents of one to five amperes in steps of one ampere.

If finer regulation is required, lamps may be coupled in series as well as parallel. The accompanying diagram shows such an arrangement, representing four lamps in parallel



and five in series. Assuming all these to be 25-c.p. lamps, then the five in series will absorb 100 volts and pass 0·2 amp.; and if these are short-circuited one at a time until only one remains, the current increase 0·2 amp. per step to 1 amp. Therefore it is obvious that with this simple arrangement the current can be varied between 0 and 5 amps. in steps of 0·2 amps., and is equivalent to a 25-way regulator.

If still finer regulation is required, more lamps may be put in series or lamps of smaller candle-power used; for instance, an 8-c.p. lamp takes approximately 0·3 amp., and three in series will give 0·1 ampere. On the other hand, if fine regulation is not required, lamps of higher candle-power may obviously be used.

The lamps are mounted in batten-type holders screwed to a wood base, the controlling switches being cheap tumblers. These fittings are very cheap, and the price of a complete rheostat, not counting the labour, may be taken as two shillings to half-a-crown per lamp. The number of lamps required will, of course, depend on requirements of the particular case.

Provisional Orders.—The Board of Trade give notice to parties contemplating the promotion of Provisional Orders in respect of electric lighting, gas and water, piers and harbours, and tramways, that for the duration of the war they will not be prepared to entertain such applications, except in cases in which they are satisfied that extreme urgency exists.

"ELECTRICAL · ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Nov. 4th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

14,146/14. Controllers. F. N. PICKETT. Face-plate starters and controllers, in which sparking at the studs is prevented by an auxiliary brush connecting the stud under the main brush to the next stud through a contactor switch, which opens and puts the resistance step in circuit after the contact has been made. (One figure.)

18,511/14. Telephony. G. MUSSO. A system of transmission of telephone impulses over lines of high capacity, wherein the main line is provided at each end with a local circuit containing a battery, transmitter, and inductance, whereby the battery maintains a charge on the line, upon which are superposed secondary and tertiary waves induced in the inductance for respectively neutralising and overcoming the capacity and resistance. (Two figures.)

20,896/14. Switches. H. C. HEATH. A tumbler switch with an automatic free handle device, consisting of a releasable mechanism between the handle and the bridging member, provided with means to release the latter from the point at which circuit is completed to the full "on" position, when an abnormal condition exists in the circuit. (Four figures.)

23,050/14. Wiring. F. W. SUTER and BAXTER & CAUNTER, LTD. Fittings for a looping-in system of wiring, in which the two wires forming the "loop," instead of being twisted together as is usual, are brought to separate contact blocks normally connected by a bridge piece removable for testing purposes. (Ten figures.)

2,636/15. Electric Ordnance. T. C. TULLIOCH. An electric gun or mine-thrower in which the projectile is propelled by the movement of an independent core accelerated in the barrel, but afterwards retarded and prevented from leaving it, by the action of a solenoid. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: BACK [Brush-holders] 459/15.

Heating and Cooking: REIMERS & KIEFER [Electric pressing irons] 21,184/14.

Switchgear, Fuses, and Fittings: MILLER [Switches] 21,593/14; LEITNER [Switches] 21,993/14; IGRANIC ELECTRIC CO. (Cutler Hammer Mnf. Co.) [Controllers] 5,104/14; R. BOSCH [Switches] 8,047/14.

Telephony and Telegraphy: WESTERN ELECTRIC CO. (W.E. Co., U.S.A.) [Ionisation amplifiers] 1,694/15.

THE E.C.A. GUARANTEED WIRING SCHEME

FURTHER progress has now been made by the Electrical Contractors' Association in its endeavour to get over the objections of the Board of Trade to the Guaranteed Wiring Scheme which we dealt with on page 405 of our issue of October 7th. We subsequently mentioned that at a special meeting held at Leicester a Committee was appointed to deal with the position. The November issue of *The Electrical Contractor* now states that a general line of action has been schemed out which will overcome the objections to the guaranteed scheme, and at the same time allow the general business of the Association to be conducted with even greater vigour than has been possible in the past.

It has been decided to run three organisations. The first will be the Electrical Contractors' Association, in much the same state as that which has prevailed up to the present. In the second place, it is proposed to form a limited trading concern possessing very wide powers and capable of carrying on all the activities of the Association, which are at present under suspicion as being outside the scope of the original charter. This limited trading concern will be able to put the guarantee scheme into immediate operation and support all the financial arrangements in connection with it. It will also

Traction: DELMEZ [Rail grinder] 29,965/14; MASCHINENFABRIK OERLIKON [Engine starter] 180/15.

Miscellaneous: BRIT. INS. & HELSBY CABLES, LTD. [Condenser circuits] 21,086/14; MELLERSH-JACKSON (*Commonwealth Electric Tool Co.*) [Electrically-actuated tools] 21,145/14, 6,302, 6,364, and 6,738/15; BLAKE [X-ray bullet localiser] 23,653/14; TEDESCHI and Rossi [Relays] 8,903/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, &c.: LA COUR [Converter] 14,516/15.

TELEPHONY: BETHENOD [Wireless telegraphy] 14,500/15.

TRACTION: REIK [Electro-mechanical driving arrangements] 14,548/15.

Opposition to Grant of Patent

Opposition has been entered to a grant on the following specification:-

12,277/14. Wireless Telegraphy. A. F. SYKES. A system of transmission in which sparking at the key is avoided by controlling the current by periodically adding substances to a liquid jet forming part of the circuit, to diminish its conductivity.

The grant of a patent has been refused on the following application which had been opposed:-

9,637/14. Telephony. E. C. R. MARKS (*Electrical Experiment Co., U.S.A.*). A microphone in which a rigid diaphragm is held between pneumatic cushions.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:-

22,844/01. Telegraphy. J. GELL. An improved form of perforator for tapes for automatic transmitters.

22,990/01. Insulation. J. W. SANKEY. A special insulating compound, which can be sprayed or painted on to iron core plates, &c.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: H. BECK [Flame arc lamp] 16,294/03; S. C. MOUNT [Arc lamp] 15,346/08.

DYNAMOS, MOTORS, and TRANSFORMERS: H. H. LAKE (*Compagnie de l'Industrie Electrique*) [Device for preventing undue rise of potential difference between the frame and windings of machines in the Thury system] 16,190/03; A.E.G. [Single-phase motors] 16,529/07.

Incandescent Lamps: SIEMENS & HALSKE [Metal filaments] 11,603/08.

Storage Batteries: K. L. BERG [Battery plates] 15,952/04.

Switchgear, Fuses, and Fittings: A. P., G. C., and P. A. LUNDBERG [Switches] 16,574/07.

Miscellaneous: C. H. PRÖTT [Electric fan and air humidifier] 16,375/02; W. E. LAKE (*C. E. Sanford, U.S.A.*) [Electric clocks] 16,500/07; A. C. KING, P. HAMER, and J. KING [Electrical variable speed gear] 15,322/08.

carry on the present trading agreements of the Association, negotiate fresh trade agreements if necessary, buy goods in bulk, to act as a co-operative undertaking, and may even go so far as to manufacture any specific article. These are the suggested powers. In the third place, it is proposed to form a trade organisation which may or may not be registered as a trade union, the object of which will be to improve trade relations generally. It will seek to protect the manufacturer, contractor, and retailer against individuals or firms who seek to maintain unfair trading conditions, and the originators of it believe it will be in an admirable position for dealing with labour troubles and workmen's organisations in general. The membership of these three organisations will be as wide as possible, and there is nothing to prevent wholesalers, factors, and even central station engineers joining.

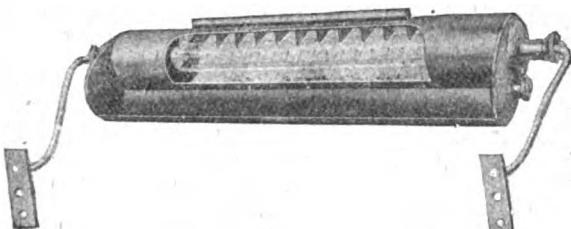
As far as arrangements go at present, it is intended that existing members of the Electrical Contractors' Association may become members of the other two organisations without extra fees or charges, although members of the other two bodies need not necessarily be members of the E.C.A. The idea also is that the capital for the trading company will be raised by the issue of shares, most of which will probably be taken up by the E.C.A. by way of investment of its reserve fund.

Nov. 11, 1915.

ELECTRICAL ENGINEERING

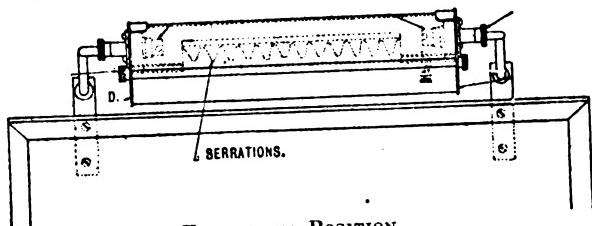
PICTURE LIGHTING

THE difficulties of lighting pictures adequately have been appreciated as one of the problems awaiting solution by the illuminating engineer, and efforts have been made to devise fittings which avoid the inconvenience of reflected light meeting the eye of the observer. The Edison & Swan United Electric



COMPLETE FITTING.

Light Co., Ltd. (Ponders End, Middlesex), have brought out the fitting of which we give two illustrations. It is claimed to be the only one capable of lighting a picture practically equal to or with a maximum illumination upon its prominent features, and is so arranged as to light only the picture. The stock length of the fitting is 18 in. over all, and takes a Tubelite lamp, but any length fitting can be made to order. The fitting con-



FITTING IN POSITION.

sists of a main tube with serrations free to turn upon supports, thus providing a means of adjustment. There is also a revolving screen to cut off the light at the bottom of the frame and from the wall below, whilst end-plates cut off the light from the sides. A notable installation of this type of fitting is in the choir stalls at Westminster Abbey. The wiring is perfectly protected, and the fixing quite simple.

LABOUR AT ELECTRICITY WORKS

THE Minister of Munitions announces that it has been brought to his notice that the working of many munition factories is being imperilled by the difficulties now being experienced by electric supply and gas undertakings providing them with power and light in retaining sufficient staff for their immediate needs. The Minister of Munitions points out that these undertakings are engaged upon work of vital importance, and the removal of their employees, even to munition work, may frequently have the effect of prejudicing the output of munitions of war. At the same time other employers are asked to assist the Ministry of Munitions by refraining from attracting labour from these essential undertakings.

The Institution and Enlistment.—Mr. C. P. Sparks, President of the Institution of Electrical Engineers, has sent a letter round to all members urging them to give immediate consideration to the employment of women in substitution of their clerical and similar staffs who are of military age. It is pointed out, however, that in the interests of recruiting it is highly important that the places of enlisted men should be kept open for them. This is an honourable rule, and so far as the Council is aware, a practically universal one in the branches of employment in question. No less desirable is it that the employment of substitutes for enlisted men should be known and declared to be temporary, and for the period of the war only. In these circumstances, the Council of the Institution impresses upon employers the importance of considering at once how their arrangements can best be remodelled as their present men are called up, and what number and class of women or other substitutes they will require.

Munitions Invention Department.—The Secretary of the Institution of Electrical Engineers has received a communication from the Ministry of Munitions asking for ideas, suggestions and inventions for appliances in connection with the prosecution of warfare on land. An Advisory Panel of scientific and other experts, upon which are a number of members of the Institution, is assisting in this work.

CATALOGUES, PAMPHLETS, &c., RECEIVED

ELECTRIC HEATING AND COOKING.—We recently referred in our "Local Notes" column to the efforts made by the Newcastle-on-Tyne Electric Supply Co. to popularise electric cooking and heating. The Company has sent us a copy of a well-got-up booklet dealing with the whole subject of electric cooking, heating, and hot-water supply. Illustrations are given of the apparatus, together with prices for purchase outright, as well as hire rates.

ELECTRIC FITTINGS AND GLASSWARE.—A very complete catalogue from Messrs. J. & W. B. Smith (15-23 Farringdon Road, London, E.C.) deals with a large range of electric fittings and glassware. This is a supplementary catalogue to be used in conjunction with the firm's general catalogue. Considerable advances in price are notified on the fittings.

ELECTRIC FIRES.—A 32-page book has been prepared by the Electrical Supplies Co. (53 Victoria Street, S.W.), in which electric fires, suitable for drawing-rooms, dining-rooms, bedrooms, &c., are fully illustrated and described. This will be gladly sent to all applicants. A two-page leaflet printed in colours, containing hints to potential users of electric fires is also useful advertising matter.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

ELECTRIC LAMPS.—Messrs. Krupka & Jacoby, Ltd. (39 Victoria Street, S.W.), have compiled a handy folder giving full particulars and prices of the lamps controlled by the Tungsten Lamp Association. Contractors will find this particularly useful, as it brings together in a small compass quite a lot of useful information.

MAZDA "POSTER" STAMPS.—Factors or contractors will find it to their advantage to make use of a new advertising medium placed at their disposal by the British Thomson-Houston Co., Ltd. (Mazda House, 77 Upper Thames Street, E.C.), in the form of a set of six gummed and perforated poster stamps for use on letters, envelopes, or wherever else the ingenuity of the recipient may suggest. The "stamps," which measure about $3\frac{1}{2}$ by $1\frac{1}{2}$, are splendidly executed in colour, and make a vigorous appeal, whether taken individually or as a set. Any number of sets will be supplied gratis to *bond fide* applicants.

ARC LAMP CARBONS.—In view of the difficulties in obtaining arc lamp carbons at the present moment, those in need of supplies will be interested to know that the Electrical Supplies Co. (53 Victoria Street, S.W.), anticipating a recurrence to a great extent of the inconvenience encountered last season in obtaining adequate quantities, have made arrangements whereby they can quote for immediate delivery from stock in their London warehouse. A considerable advantage in price as compared with last season's figures is also offered. The Company inform us that they have a complete range of all sizes and types, and particularly 18 mm. by 12" cored, and 12 mm. by 12" solid for open type arc lamps; also 13 mm. by 12" solid suitable for enclosed arc lamps.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Athy (Ireland).—The Council invites tenders for lighting the town by electricity. The necessary permission will be granted for the erection of overhead lines or for the laying of underground mains. The public lighting will be fifty 50-c.p. lamps, for which the sum of £75 per annum for three years is offered. The present price of coal-gas to private consumers is 6s. 3d. per 1,000 cubic feet. Schemes should be sent to the Town Clerk not later than December 6th.

Belfast.—A loan of £3,443 is to be sought for services and meters during the next two years.

Greece.—Reporting upon the trade of the Piræus district for last year, the British Consul calls attention to the good market for electrical machinery, &c., and states that the reason for the success of Germany and Austria hitherto has been due to their sending very capable representatives with a practical knowledge of their duties, explaining to the buyers all they want to know about the machinery, and ready to agree to any alterations to meet local requirements. Representatives of British firms, he adds, are seldom seen in Greece.

London: Hackney.—Cable and switchgear are required in

connection with supply to a new factory which is being erected in the district on behalf of the Minister of Munitions. We refer at greater length to this under "Local Notes."

Luton.—A L.G.B. inquiry was held last week concerning a loan of £25,650 for new plant, made up as follows:— Generating plant, £14,450; sub-station and plant, £5,200; and H.T. and L.T. cables, £6,000.

Manchester.—Turbo-alternator and induced draught plant. Chief Electrical Engineer, Dickinson Street. November 17th.

Turton.—A scheme for supplying Harwood has been prepared by the Borough Electrical Engineer. The cost of erecting the necessary overhead cable is put at about £220.

West Bromwich.—Extensions estimated to cost £8,850 are to be carried out, by agreement with the Minister of Munitions.

West Hartlepool.—Additional boiler plant is required at the Seaton Carew power station.

Wigan.—The L.G.B. has sanctioned a loan of £6,700 for new boilers.

Wiring

Glamorgan.—Upper Loughor School. Clerk, County Hall, Cardiff. November 15th.

Glasgow.—Bernard Street School, Bridgeton. School Board Offices, 129 Bath Street.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Belfast.—Waggon repair shops, Adelaide Street. Great Northern Railway Co. (Ireland).

Bolton.—Extensions to Bradford and Hill Fold mills.

Devonport.—Children's Home.

Miscellaneous

Chatham.—Twelve months' supply of electric lamps. Borough Surveyor, Town Hall. November 24th.

Egypt.—The Alexandria Postmaster-General requires a twelve month's supply of electric lamps and fans. Superintendent of Stores, G.P.O., Alexandria. December 1st. Further particulars at 78 Basinghall Street, E.C.

Ireland.—Twelve months' supply of telegraph materials for the Sligo, Leitrim & Northern Counties Railway Co. Secretary, Enniskillen. December 1st.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

London.—Ozonair, Ltd., has recently received a further order from the London Electric Railway Co. for "Ozonair" plant. This is for the Leicester Square station of the Charing Cross, Euston & Hampstead Tube, and constitutes the seventeenth installation supplied to this Company.

Manchester.—The Electricity Committee have accepted the following tenders:—Bruce Peebles & Co., Ltd. (Edinburgh), for one 300-kw. motor converter for sub-station; Ferranti, Ltd. (Hollinwood), for two sets E.H.T. switchgear; M. Louis Prat (Paris) and Babcock & Wilcox, Ltd. (London), for induced draught plants.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night, was £90 to £91 (last week, £89 to £90).

Agencies.—H.M. Consul-General in Paris, says the *Board of Trade Journal*, reports that an important engineering firm in that city desires to represent United Kingdom manufacturers of electrical supplies of all kinds. The firm in question points out that after the war there will be a great demand for electrical supplies for refitting the factories, &c., in those parts of France at present invaded. A unique opportunity will be afforded for United Kingdom manufacturers to secure a large part of the market formerly in German hands.

Competition.—The Electrical Supplies Co., as will be seen from our advertisement columns, is offering a prize of two guineas for the best suggestion of a name for their new premises.

APPOINTMENTS AND PERSONAL NOTES

Electricians are required at the South Eastern Hotel, Deal, and by the Lechlade Light & Power Co. (See advertisement on another page.)

Apprentices are required in the Keighley and Swindon Corporation Electricity Departments. Applications to the Borough Electrical Engineer in each case.

LOCAL NOTES

Bo'ness: *The National Co.'s Lease.*—The National Electric Construction Co., which leases the electricity works, proposes to make temporary extensions at an estimated cost of between £6,000 and £7,000. It is intended that payment for the work should stand over until after the war, when the Council should apply for borrowing powers, the Company receiving 6 per cent. on their capital outlay. Meanwhile, this will be charged on the profits of the undertaking.

Dover: *Garage Lighting.*—The Borough Electrical Engineer has been making an investigation of the number of units taken by garages in the town, and has found that the average is only 24 units per annum, but the capital charges in respect of each installation is 16s. 8d. a year, and his suggestion that a minimum of 10 units should be charged each quarter has been adopted. In the case of garages lighting through pre-payment meters, the minimum is to be 20 units per quarter.

London: *Hackney: New Factory.*—The Electricity Committee report that for some time past they have been in negotiation with Messrs. Dick, Kerr & Co., acting on behalf of the Minister of Munitions, in reference to a supply of electrical energy for a new factory now in course of erection in the district. The conditions agreed include the provision of the necessary additional switchgear and the laying of the requisite cable at the expense of Messrs. Dick, Kerr, who will repay the cost in monthly instalments as the work proceeds. The cables and switchgear are to remain the property of the Minister of Munitions, and when they cease to be used for their present purpose the Council is, before purchasing new cables and switchgear, required to purchase those now being installed from the Minister of Munitions at ruling prices, subject to deduction for the ascertained cost of recovery and unavoidable waste in adaptation. Supply is to be given at 6,000 volts, three-phase, 50 periods.

St. Marylebone: *Wiring Contracting.*—Since December, 1913, the Electricity Department has passed on inquiries for wiring work to appointed district contractors, subject to the price being satisfactory and to the contractors purchasing supplies from the Council, again subject to the price not being less favourable than they could obtain elsewhere. It appears, however, that the purchases of stores from the Department by the contractors have been comparatively small, and the anticipated advantages to the Department have not been fully realised. The Electricity Committee now recommends that the district contractors' arrangements be terminated, and that in future consumers should be left free to select their own wiring contractor.

Scientific and Industrial Research.—A committee of the Privy Council for Scientific and Industrial Research is inviting various scientific societies to furnish statements indicating specific problems requiring scientific investigation. The Council of the Physical Society asks Fellows contemplating or prosecuting researches to communicate full particulars of them to the Secretary.



ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
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Rates for Small Prepaid and Official Advertisements, see p. vi.
Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

Teleg. "Circling, Fleet, London."

Telephone No.: 5509 Holborn

Cheques to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

MR. B. WELBOURN's address, as Chairman of the Manchester Section of the Institution of Electrical Engineers, was devoted to the production and properties of copper. Among other points dealt with was the effect of wear on the tensile strength of overhead trolley and electric railway wires (p. 460.)

THE B.E.A.M.A. are taking definite steps to ensure an active attack by us on German export trade after the war. This statement was made by the Secretary at an informal dinner last Thursday, when a clever review of German methods was given in a Paper by Mr. F. W. Wile (p. 460).

THE Engineering Standards Committee have now published their Report No. 72 dealing with British Standardisation Rules for Electrical Machinery (p. 461).

Two specifications of telephone relays and one relating to condenser circuits were published last Thursday at the Patent Office. Patents for resistances and intercommunication telephones expire this week after a full life of fourteen years (p. 462).

OUR Questions and Answers page this week deals with the comparative merits of two forms of multiplex armature windings (p. 462).

THE Harrogate Electricity Department is pushing the use of electricity for all domestic purposes, in conjunction with the rateable value tariff (p. 463).

PROFESSOR MARCHANT's presidential address to the Liverpool Engineering Society was on the subject of the relation of science to practice in engineering (p. 464).

SHORT articles deal with half-watt lamp fittings,

lighting and munition work, a shell inspection lamp, and a conduit spacing support (pp. 464 and 465).

MAINS and house services are required at Gravesend (£2,500); high-tension cable-testing outfit at Sydney; additional generating plant at Huddersfield; Diesel engine and generator at Pembroke, and mains and switchgear at Salford (p. 466).

A CONTRACT for power worth £20,000 per annum has been entered into by the Bradford Corporation.—The purchase of the electrical undertaking of the Tasmania Hydro-Electric Power & Metallurgical Co. by the Tasmanian Government is referred to (p. 466).

EDISON & Swan United Electric Light Co. and Drake & Gorham both show good results for last year (p. 466).

THE appeal of the Osram Lamp Works, Ltd., against the judgment of Mr. Justice Joyce, with regard to the alleged infringement of the Osram metal filament lamp patent by the Pope Electric Lamp Co. is now being heard (p. 466).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY COL. C. B. CLAY, V.D., COMMANDING.
Drills, 5.25 to 7.25; 7.25 to 8.25 p.m.

(To-day) Thurs., Nov. 18th: Sections III. and IV., signalling section, shooting.

Fri., Nov. 19th: Sections III. and IV., technical. Sections I. and II., squad or working party. Signalling section and recruits.

Sat., Nov. 20th: Uniform Parade, 3.0 p.m.

Mon., Nov. 22nd: Sections I. and II., technical. Sections III. and IV., squad, signalling section, and recruits.

Tues., Nov. 23rd: School of Arms with Architects Corps, 6.0 to 8.0 p.m.

Thurs., Nov. 25th: Sections I. and II. and Signalling Section, shooting.

Fri., Nov. 26th: Sections III. and IV., technical. Sections I. and II., squad, signalling section, and recruits.

The opening of the new Headquarters of the Corps will be held on Wednesday, Dec. 1st, 6.30 p.m. All members should make a special point of attending in uniform.

Volunteers for trench work on Sundays are requested to give early notice to their Section Commanders.

Arrangements for the Week.—(To-day) Thursday, Nov. 18th. Institution of Electrical Engineers. Presidential Address, by C. P. Sparks. Presentation of premiums. 8 p.m.

Saturday, Nov. 20th. Birmingham & District Electric Club, Swan Hotel, New Street. "Organising the Electrical Industry," by H. Foulds. 7 p.m.

Wednesday, Nov. 24th. Institution of Railway Signal Engineers. I.E.E., Victoria Embankment. 2.30 p.m.

Birmingham Section, I.E.E. University. "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field. 7 p.m.

Diesel Engine Association. I.E.E., Victoria Embankment. Discussion on "Cracked Pistons."

Thursday, Nov. 25th. Institution of Electrical Engineers. "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field. 8 p.m.

Faraday Papers.—At the meeting of the Institution to-night a valuable collection of Papers of Michael Faraday will be presented to the Institution in trust by Mr. D. J. Blaikley, who is the husband of the last surviving niece of Faraday.

COPPER FOR ELECTRICAL PURPOSES

M R. B. WELBOURN'S address as Chairman of the Manchester Section of the Institution of Electrical Engineers, which was delivered on Tuesday, consisted of an extremely valuable treatise upon the production and properties of electrolytic copper for electrical purposes—a subject which, we believe, has hitherto never been completely covered in a single publication.

In some introductory remarks Mr. Welbourn first congratulated Mr. C. J. Beaver, who is one of the Vice-Chairmen of the Section, for having carried off the highest award of the Institution last session for his Paper on "Cables" (ELECTRICAL ENGINEERING, November 19th, 1914, Vol. X., p. 597), and Mr. H. S. Marquand upon winning one of the Students' Premiums for his Paper on "Electric Welding." He also referred briefly to the war, mentioning that 1,100 out of 6,600 members are with the Forces, while a large proportion of the remainder are engaged on war service.

The world's output of copper is normally about one million tons per annum, this figure having been slightly exceeded in 1912. The United States produce 55 per cent. of the whole, and the whole of North and South America 73 per cent. Japan is the next biggest producer with 65,500 tons, and other countries' contributions are as follows: Spain and Portugal, 59,000 tons; Russia, 33,000 tons; Australasia, 47,000 tons; the combined product of Germany, Hungary, Turkey, and Bulgaria (when on a peace footing), 35,000 tons; and Great Britain 300 to 400 tons (although the production in 1860 was 15,968). The total production of the British Empire is close on 100,000 tons, being therefore about one-tenth of the world's output. The four biggest consumers in 1912 were: North America (365,922 tons), Germany (243,173 tons), Great Britain (147,551 tons), and France (106,753 tons).

About 70 per cent. of the world's copper output is refined electrically, and Mr. Welbourn first gave a brief but clear account of the various consecutive processes employed, dealing with the initial reduction and purification of the metal, its electrolytic refinement, and the processes of rolling, drawing, and annealing.

He next referred to the British, American, and International standards. The last-mentioned, which were published by the International Electrotechnical Commission in March, 1914, has not yet superseded the previous standard in this country, but has been adopted in the new Standardisation Rules of the American Institute of Electrical Engineers published last July. They fix the resistance of a standard annealed copper wire 1 metre long and 1 sq. mm. section at 20° C. at 0'0172414 (1/58th) ohm; the density of pure annealed copper at 20° C. as 8'89 grammes per c. cm.; and the temperature coefficient (at "constant mass") as 0'00393 at 20° C.

Mr. Welbourn recommends a standard for hard-drawn copper based on investigations made by Mr. D. R. Pye (*Journal of the Institute of Metals*, No. 2, 1911, Vol. VI.), and in accordance with the following empirical formula: A tensile strength in tons per sq. in. of 30–20 D, where D is the diameter in inches; and an extension on a marked 10-in. length (including the point of fracture) of not less than $e=5$ D, where e is the extension per cent. He is of opinion that a wire complying with this standard would also automatically comply with the British Post Office twisting test. Standards of elasticity should, he thinks, also be decided upon, given in terms of minima fixed for the ratio of elastic limit to breaking strength, i.e., the "limit of proportionality"; this varies from about 50 per cent. for wires of 0'08 in. diam. to about 70 per cent. for wires of 0'5 in. diameter. It is interesting to note that on stranded wires the effective strength is about 10 per cent. below that of the same number of straight wires, probably due to the difficulty of getting the strain evenly distributed among the wires of a strand, and the fact that the layers of wires are of unequal length.

Mr. Welbourn described some instructive experiments to ascertain whether there was a variation of tensile strength of hard-drawn copper wire due to wear. He started with a circular trolley wire 0'4 in. diameter, and turned six pieces down to different sizes down to 0'25 in., to ascertain whether the widely-held belief is correct that the hardness is due to the skin being hardened during the drawing process. The tensile strength remained practically constant. To find whether this was due to the wire being hardened in the lathe, he performed a similar series of experiments with a 0'25 sq. in. grooved contact wire for an electric railway, reproducing the wear by gently filing away the face. In this case the yield load actually remained constant while the sectional area was reduced from 0'246 to 0'207 sq. in., and was only reduced slightly when 0'195 sq. in. was reached; the actual yield stress in tons per sq. in. therefore actually increased.

Space has only permitted a brief abstract of Mr. Welbourn's excellent address, and we refer our readers to the fuller account which will appear in due course in the *Journal* of the Institution of Electrical Engineers.

Killed in Action.—Among the list of those killed in action on November 5th we regret to notice the name of Lieut. Nigel Crompton, the youngest son of Col. Crompton, C.B. Lieut. Crompton was with the 89th Field Co., R.E., attached to the 101st Company.

GERMAN—AND ENGLISH—BUSINESS METHODS

A T an informal dinner of the British Electrical and Allied Manufacturers' Association, an interesting Paper (read by the Secretary, Mr. D. N. Dunlop, in the absence of the author) was contributed by Mr. F. W. Wile, late Berlin correspondent of the *Daily Mail*. The subject was "German Business Methods as I knew them," but even more interesting than the brightly written and outspoken Paper itself was a statement by Mr. Dunlop that definite and far-reaching steps are already being taken by the Association to ensure an active attack by us on German export trade after the war.

Mr. Wile prefaced his review of German methods by explaining that he is an American, and "a neutral," that is to say, he is thoroughly neutral in so far as it is a matter of the most complete indifference to him as to how, when, where, or by whom Germany is crushed, so long as the process is prompt, decisive, and thorough. He is an American who feels that the guns of our Grand Fleet stand not only between German domination and the liberties of these islands, but between German tyranny and the freedom and security of the United States itself. He described German business methods as a strange combination of scientific efficiency and diabolical unreliability. Never in all his long residence in Germany could he reconcile the skill, enterprise, and industry of the average German business man with his incredible disregard for the elementary principles of honour. The music-hall joke of the year in Berlin four or five winters ago was the reply given by a comedian who was asked the meaning of "word of honour"; a "word of honour," he said, was something you gave when you did not want to bind yourself in a business way! The German does not live up to his word of honour in business because he is not expected to. A more subtle epigram, evolved by Mr. Wile himself, was: "A German always keeps his word because he cannot get anybody to take it."

If you go to Germany to give an order, Mr. Wile explained, a director who can talk English as well as you can will meet you at the station and entertain you luxuriously for a week, but you will not have gone half a day's journey toward home before your late opulent host will begin to plot to get the best of you under the contract, whose ink is not yet dry. He will only keep the contract if it is in his manifest interest to do so. The sacredness of a verbal promise is an utterly unknown quantity in Germany, and in the German language there is no such word as "gentleman." Imitation is a vaunted German commercial virtue. There is an immense traffic in illicit business information in Germany. An engineer or a department superintendent or a managing director will induce a bank to finance a competitive works purely on the assurance that, through his confidential knowledge, he is able to snatch the business of an older-established concern in whose employ he has been for many years, and often enough still is. It is considered perfectly ethical from a German banker's standpoint to supply funds for industries born under these criminal auspices.

Mr. Wile next referred to the praiseworthy features of German industrial organisation, and alluded to the passion of the German manufacturer for specialisation. To this is due his habit of employing an extraordinarily large number of engineers. An American engineer once told Mr. Wile that in a works employing 500 men it was not uncommon in Germany to find a staff of 50 engineers, who are content to devote their skill and energies indefinitely to a specific and more or less minor speciality, and to concentrate on developing it, instead of aspiring to generalise in the engineering field, even though thereby the status and emolument of the engineer might be considerably improved. This specialising mania of the Germans is all part and parcel of their infinite capacity for taking pains—a trait which has as much to do with their conquests in the foreign trade realm as any other one factor. The readiness of the German to make anything for anybody anywhere is one of the secrets of his international commercial progress. The German has always looked up to Great Britain as the master business mind and the Mecca of all those who would study commerce at the fountain head. No modern young German business man, at least before the "Gott strafe England" era, considered that he had had a proper start in life without personal acquaintance with the commercial practices of this country. The Allgemeine Elektricitäts Gesellschaft of Berlin, when it decided about ten years ago to go in for export trade on a broad scale, entrusted the organisation and management of that department to an English engineer, 31 years of age. When he took charge, the A.E.G. were doing £100,000 a year in export. When he left their service, at the outbreak of the war, they were doing £2,000,000. Yet, even though Germany has traditionally looked upon Britain as the mother of commerce and trade, the Germans have undoubtedly outstripped this country in respect of organisation. It is to the tremendous zeal and application of the German, especially in export trade, that his success is principally due. He is an insatiable student of the demands of the particular market on which he has designs. He puts its local customs, prejudices, and traditions under his microscope before he begins catering for its business. He learns, in particular, all there is

to know about its credit system, and prepares to accommodate himself to it. He will not be ashamed, if necessary, to wait three or five years for his money, where an Englishman, a Frenchman, or an American would not dream of extending credit for more than 90 or 100 days. German embassies and legations, besides being centres for purely diplomatic intriguing, are headquarters of the German business organisation in their particular capitals and countries. A German business man never appeals to them in vain for counsel or assistance. The German consular service throughout the world is a business-getting service pure and simple.

"I am aware," said Mr. Wile, "that British industry in general, and your own branch in particular, have concentrated during the past year on war and Government work. I know that this has seriously interfered with the prosecution of export trade; but unless you begin, now, to think of things after the war, I am very much mistaken if you will not find that the Germans have out-generalled you. You may be quite sure that, with their marvellous faculty for leaving no contingency unanticipated, the Germans are at this very hour busily planning and plotting for a new raid on the world's markets, of even a more determined character than any effort they have ever put forth in the past."

BRITISH STANDARDISATION RULES FOR ELECTRICAL MACHINERY

THE Engineering Standards Committee have now published their Report No. 72 dealing with new British Standardisation Rules for Electrical Machinery (excluding motors for traction purposes). This report supersedes Nos. 17 and 36, previously issued. The main features of the new rules were pointed out by us in a recent issue (October 21st), and now the report is published we are able to examine it a little more in detail. It is particularly pleasing to note that the new standards have been decided upon by the Engineering Standards Committee, not alone, but in co-operation and consultation with other bodies of international importance. The rules regarding temperature limits, for instance, are based on the limiting temperatures for insulating materials agreed to at the last Plenary Meeting of the International Electrotechnical Commission, held in 1913. The Committee has also had the benefit of the co-operation of the American Standards Committee, and a conference held in London, at which were present official representatives of the American Institute of Electrical Engineers, went far towards bringing about agreement on all essential details. At this conference the Canadian National Committee of the I.E.C. was also officially represented.

The Sub-Committee which has been entrusted with the drafting of these Rules, and of which Dr. R. T. Glazebrook, C.B., is Chairman, includes:—Messrs. C. H. Wordingham and L. J. Steele (representing the Admiralty), Capt. G. L. Hall, R.E., and G. H. Roberts (representing the War Office), H. C. Gunton (representing the G.P.O.), Llewellyn Preece (representing the Crown Agents for the Colonies), A. R. Everest, and C. Rodgers (nominated by the B.E.A.M.A.), John Christie (nominated by the Incorporated Municipal Electrical Association), W. Duddell, Dr. Gisbert Kapp, H. W. Miller, W. M. Mordey, C. H. Merz, W. H. Patchell, Capt. H. R. Sankey, R.E., Alexander Siemens, and Roger T. Smith.

With this weight of authority behind the report, and with the work done on an international basis, the new standards are likely to be universally recognised, and to become permanent in nature.

The Rules, which cover transformers, generators, and motors (except traction motors), are divided into 20 sections, dealing with types of machines, classes of rating, maximum cooling air temperature, measurement of temperature, embedded temperature detectors, limits of both temperature and temperature rise, tests for mechanical strength and stalling torque, dielectric tests, rating plate information, transformer terminal marking, &c. The subjects are dealt with very completely, the report containing 123 clauses.

The most novel feature of the rules, as we previously pointed out, is the adoption of the "continuous maximum" basis for rating, sometimes called the "single rating" basis. With regard to this, the report has a note that "it has been the general practice in the past to specify the output of electrical machinery intended for continuous service on the basis of a normal continuous rating with a definite over-load allowed for a limited period. The British Standard Rating as defined in these Rules, includes the equivalent of the previous over-load, and therefore only such momentary excess loads are recognised as are provided for in these rules."

In connection with this alteration of rating, it is interesting to note that the Committee make recommendations as

to the point of maximum efficiency for which the machine is designed, stating that this should be about 80 per cent. of the new rated output. Further, with regard to prime movers for generators, a note is inserted that "the most economical output of the turbine (i.e., the output at which it attains its maximum steam economy) should not correspond with the generator rating in kw., except under special circumstances. In general, it will be found preferable, when ordering a combined set, to specify that the most economical output of the turbine shall be equal to 80 per cent. of the kw. rating of the generator as defined in these Rules, i.e., equal to 80 per cent. of the maximum continuous output of the generator in kw. The average output of the alternator is usually something between three-quarters of the rated output and the rated output, and the average output of the combined set should clearly be the most economical output for the prime mover. . . . It should further be stated that, for mechanical reasons, the steam inlets should be capable, by means of bye-passes or otherwise, of dealing continuously with outputs 12 per cent. in excess of the rated output, which is 40 per cent. in excess of the economical output as defined above."

This note, it may be observed in passing, is typical of the excellence and thoroughness of the information given throughout the book.

With regard to the temperature of the cooling air for machines, it is noteworthy that a maximum value has been adopted instead of an average value as formerly. The Committee point out that the life of a machine depends to a great extent on the maximum temperature to which the insulation is exposed, and that this temperature depends on the load on the machine and also on the temperature of the cooling air. Therefore in order to establish the permissible temperature rise of a machine so as never to exceed the standard temperature limits, it is necessary to consider the maximum temperature to which the cooling air may rise, and the value of 40° C. has been adopted.

Full information is given in regard to temperature tests, and the methods to be adopted for the measurement of the temperature are also specified. In certain specific cases a thermometer measurement alone is specified; in some instances, in which the resistance method would be applicable, a thermometer alone may be employed, but with 5° C. reduction in the maximum temperature. The use of embedded temperature detectors, i.e., thermo-couples or resistance thermometers introduced during the building of the machine, is recognised for large machines.

The information to be given on the rating plate of a machine is set out in detail. A machine which fulfils the specifications of the standard rules is to have a distinctive special sign. Vector diagrams, for stamping on the rating plates of three-phase transformers, are included, and the methods to be adopted for the marking of the terminals of single and three-phase transformers are specified.

A particularly useful section of the report is that containing information which should be given with an inquiry, or when ordering machinery.

The Report will be most valuable, if not an absolute necessity, to designers, manufacturers, and users of electrical machinery, as well as to consulting engineers. The authoritative establishment of these standards will be a boon to the electrical industry, which has so long been in a state of confusion in regard to the matters dealt with, owing to the large number of standards in use and the numberless specifications produced that have had no regard for any standards.*

The Hefner Lamp.—We have received from the National Illumination Committee of Great Britain details of a research carried out by Dr. E. Ott and others, at Zurich, on the dependence of the light of the Hefner lamp on atmospheric conditions—more especially atmospheric pressure. The result shows that over normal ranges of pressure, i.e., from 816 to 716 mm., the reduction in the light is only about 1 per cent. for a reduction in pressure of 100 mm. of mercury. For the next lower 100 mm., however, i.e., from 716 to 616 mm., the reduction is as much as 7 per cent. The effect of aqueous vapour and carbon dioxide was very small, and it was uncertain, varying with the origin of these products, and the results of Dr. Ott's experiments show that these effects can generally be neglected if work with the lamp is performed in a large and well-ventilated room.

The "Generators."—On account of the conditions, it has been decided not to carry out the full programme this year, but in order to meet the wishes of a great majority of the members, a dinner will be held at the Trocadero Restaurant on Friday, December 3rd, for which an exceptionally attractive programme has been prepared.

* For the convenience of our readers we shall be pleased to send them copies of the report by return of post. The price is 10s. fid. (abt. 10s. 1d.). Orders, which should be accompanied by a remittance, should be addressed to the Kilowatt Publishing Co., Ltd., 203, Temple Chambers, E.C.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Nov. 11th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

21,096/14. Condenser Circuits. BRITISH INSULATED & HELSBY CABLES, LTD., and H. HIGHAM. In A.C. circuits, containing condensers, those designed to work at a higher voltage than that of the circuit are adapted to varying lower voltages by employing an inductance in series with the condenser, so that condensers of less capacity can be used than would otherwise be required. (One figure.)

1,694/15. Telephone Relays. WESTERN ELECTRIC CO., LTD. (*W.E. Co., U.S.A.*). Thermo-ionic amplifiers for telephone currents in which a maximum efficiency is obtained by placing the input electrode as close as possible to the source of ionisation or the cathode while sufficiently far to insulate it. (15 figures.)

8,903/15. Telephone Relays. V. TEDESCHI and A. G. ROSSI. A reversible relay for amplifying the energy of small periodic currents through the medium of mechanical work. The rotation of a solid continuous metal disc of high conductivity determines the inductive effect between two stationary identical symmetrical and insulated windings at right angles to each other and to the plane in which the disc rotates so that they shall not present any mutual induction when the disc is stationary. (9 figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: B.T.-H. CO. (*G.E. Co., U.S.A.*) [Moulded insulation composition] 24,419/14; RAILING and GARRARD [Cable joint boxes] 378/15; MIDLAND ELECTRIC MFG. CO. and BARBER [Distribution boards] 900/15.

DYNAMOS, MOTORS, and TRANSFORMERS: LA COUR [Rotary converters] 10,562/14; FALKENTHAL [Converters] 11,837/14; THOMPSON and M.L. MAGNETO SYND. [Coil winding machines] 22,639/14; YARWOOD [Motor starting] 7,244/15.

Heating and Cooking: CABLE ACCESSORIES CO. & REEVES [Heating element] 3,513/15.

Incandescent Lamps: H. G. FINCH and POYNTER [Incandescent

lamps] 16,850/14; SIEMENS & HALSKA A.G. [Carbon filaments] 4,776/15.

Storage Batteries: JACOBSON [Charging regulators] 21,509/14; WARD and RICHARD PAPE, LTD. [Storage batteries] 23,485/14.

Switchgear, Fuses, and Fittings: MIDLAND ELECTRIC MFG. CO. and BARBER [Switches] 21,761 & 21,978/14 & 901/15; IGRANIC ELECTRIC CO. (*Culver-Hammer Mfg. Co.*) [Controllers] 3,570/15.

Telephony and Telegraphy: SMITH [Telephone systems] 21,338/14; STRATFORD-ANDREWS and ORLING [Wireless receivers] 21,474/14; AGNER [Wireless telegraphy] 6,217/14; HACKETT [Telephone transmitters] 8,203/15.

Miscellaneous: SIGNAL GES. [Device for use with motors directly coupled to pumps, water sirens, &c.] 10,048/14; MELLERSON-JACKSON (*Commonwealth Electric Tool Co.*) 21,143/14; GREVILLE [X-ray apparatus] 21,609/14; THOFERN [Batteries] 5,395/15; BRIT. WESTINGHOUSE CO. [Vapour rectifiers] 8,173/15.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

23,456/01. Resistances. H. A. MAVOR and MAVOR & COULSON, LTD. Resistances comprising coils of wire held within a perforated insulating and fireproof body with the convolution spaced apart so as not to be touching.

23,838/01. Intercommunication Telephones. I. H. PARSONS and T. SLOPER. An intercommunication telephone system in which the conversation between any two stations cannot be overheard from a third station.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, and TRANSFORMERS: E. C. KETCHUM [Homopolar dynamos] 16,729/06; J. H. HOLMES [Switch for short-circuiting slip-rings of induction motors] 17,520/09.

Instruments, Meters, &c.: B.T.-H. CO. (*G.E. Co., U.S.A.*) [Recording instruments] 17,763/09.

Switchgear, Fuses, and Fittings: B.T.-H. CO., H. BACON, and E. B. TUPPEN [Slow motion starters] 15,791/08.

Telephony and Telegraphy: W. AITKEN [Switches for private branch exchanges] 15,818/08; A. E. VICKERY [Electric order telegraphs] 1,948/09; C. BERARDI [Switches and indicators] 17,488/09.

Traction: RAILLESS ELECTRIC TRACTION CO. (*M. Schieman*) [Overhead collectors] 15,753/08.

Miscellaneous: H. P. & R. L. PÖRSCKE and G. WEDEKIND [Primer batteries] 16,751/04; METALLURGiska PATENT-AKTIE-BOLAGET [Magnetic separators] 16,780/07; J. E. NEWMAN and J. LODGE [Electrical treatment of plants] 17,046/07; F. STEINERT and H. STEIN [Magnetic separators] 17,490/09.

good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,469.

The lighting of a small hall is effected by 54 metal-filament lamps connected to a 100-volt A.C. supply of 50 periods per second frequency. What is the best method of using choking coils for dimming purposes, on two groups of 26 100-watt lamps and 20 32-watt? The remaining eight lamps are 40-watt, and require no dimming. How does the candle-power of a lamp vary with the applied voltage?

(Replies must be received not later than first post, Thursday, Nov. 25th.)

ANSWERS TO No. 1,467.

Explain the relative advantages and occasions for using duplex re-entrant (symbol ) and duplex non-re-entrant (symbol ) windings on direct-current armatures. Can equalising connections be fitted to either type, and if so, is it advantageous to do so?—"Enquirer."

The first award (10s.) is given to "Y.Z." for the following reply, which is printed in abridged form:—

The sort of case in which duplex windings might conceivably be useful is when an armature has to be made for a low voltage and a high current, a condition which would ordinarily lead to a very small number of commutator parts, necessitating very wide strips and difficult construction, as well as to very large armature conductors, commuting too much current in a lump, so to speak, and tending to produce a sensitive and difficult machine. One way of increasing the number of commutator parts and

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of

diminishing the current per armature circuit, is to use one of the duplex windings referred to in the question. Another case in which such a winding is useful is pointed out by Arnold, and is that in which, in a multipolar machine, the output and speed are such that neither a pure lap winding nor a pure wave winding is altogether good, the former because it has too many conductors, leading to bad space factor and other disadvantages, and the latter because it has too few conductors, leading to too few commutator parts and too great an armature current per circuit. The pure lap winding has as many circuits as the machine has poles, while the pure wave winding has only two circuits. By using a duplex (or other multiplex) winding, a compromise can be effected, and a number of circuits intermediate between those given by the pure lap and pure wave windings can be obtained which will give a suitable number of conductors on the armature. The first sort of case, that of low voltage, high current machines, leads to duplex (or multiplex) lap windings; the second sort of case, that of large machines where a compromise between lap and wave windings is required, with an intermediate number of circuits, leads to duplex (or multiplex) wave windings.

Coming now to the relative advantages of re-entrant and non-re-entrant windings, it may be said there is little to choose between them, but the preference on the whole is for a non-re-entrant winding. The chief fault of these windings is that the two parts are very liable to get connected together at unintended places, by reason of dirt collecting between commutator bars. This leads to bars being connected under a pole piece, instead of only at the brushes, and if a tooth comes between, differences of potential are set up which cause internal circulating currents to flow in the winding. Hence the windings should be kept clear of each other. Now the re-entrant type has naturally every bar connected to every other bar, and it is thus impossible to test out simply to discover the place where an unintended short circuit has taken place between the windings; but the non-re-entrant type is fairly easy to test out for this, because normally the windings are separate, and it is possible, by sending a current from one to the other through the short circuit, to find where the latter is by finding where the potential difference between the two windings is least. Hence for this reason the non-re-entrant type is better than the other.

As regards equalisers, these can be fitted in certain circumstances. For instance, in a duplex lap winding, if there are two coils side by side in a slot, and if these coils, at the other side of them, also lie in the same slot, so that a tooth never separates the pair of coils, equalisers can be put between two such coils at various points of the winding. If these be fitted, they carry any internal currents which would otherwise pass by the brushes and cause sparking. It is therefore a distinct advantage to fit equalisers. In the case of a duplex wave winding, the same sort of condition holds good. The writer had once to deal with a number of armatures which gave great sparking trouble, and found they were duplex wave windings, with, fortunately, two coils per slot. By bridging over between successive pairs of commutator bars, corresponding to pairs of coils in a slot, and so practically converting the winding into a single one with half the number of bars, the trouble disappeared entirely. Arnold deals very exhaustively with the subject of these equalisers, and declares that all windings of this sort must have equalisers in order to work.

Finally, if one is tempted to use these windings, let him follow historic advice, and don't! It is much better to use two commutators on a low voltage, high current machine, than one commutator connected to a duplex winding; and as for a multipolar machine, while it is true that places occur in a well-designed line where the difficulty appears which has already been indicated, i.e., the apparent unsuitability of both lap and wave windings of the ordinary sort, other devices are open to the experienced designer to get round this difficulty than that of adopting a winding which may prove in the end even worse than the alternatives it avoids.

The second award (5s.) is given to "F.M.D." for the following reply, which we have abridged:—

The winding represented by the symbol  is usually called duplex singly re-entrant, and  duplex doubly re-entrant.

Lap windings.—The rules for a lap winding are:—

Z , the number of coil sides, must be even.

T_f and T_b , the front and back winding pitches measured in spaces, must both be odd, must differ by " $2m$ " (" m " being the multiplicity), and should each be about one pole pitch.

Z/p , the re-entrancy (that is, the number of separate and distinct parts in the symbol of the winding), is the G.C.F. of $Z/2$ and " m ."

A duplex single re-entrant lap cannot be provided with equalising connections, for since Z is not divisible by $2mp$, neither can the number of commutator segments be divisible by $2p$, that is to say pairs of commutator segments exactly two pole pitches apart cannot be found. The rule for equalising connections is that they shall join only those segments which are separated by two, or a multiple of two, pole pitches.

In the case of a doubly re-entrant duplex lap winding there need be no difficulty in choosing Z so that equalising connections may be put upon each re-entrant section, but it is not advisable

to interconnect the two re-entrant sections unless this can be done by joining the back end of a coil belonging to one of the re-entrant sections to the front end of the adjacent coil of the other section. This connection makes the potential of each commutator segment midway between the potentials of the two adjacent segments.

Wave windings.—The simplest possible form of wave winding is one which, advancing two spaces each time it completes a tour of the armature, closes after advancing exactly one double pole pitch. A duplex wave winding consists either of two of the simple waves just spoken of, in which case it is called doubly re-entrant, or it consists of one winding which advances two double pole pitches before closing, and is then called singly re-entrant. A simplex wave winding demands only two brushes, each thick enough to bridge over one commutator segment; a duplex wave may have either two brushes only, each brush bridging over two segments, or four or more brushes of single thickness. In either case equalising connectors should be provided. These serve in the first case to interconnect the re-entrant sections, and in the second case to interconnect corresponding points on the two plexes (or folds) of the winding. Corresponding points are points separated by two or a multiple of two pole pitches. It is not easy to explain in few words why equalising connectors should be needed upon a multiplex wave winding, but their use is found to improve the commutation.

Modern practice avoids the use of multiplex windings, whether lap or wave, and when they have to be used it is essential to provide them with equalising connectors (connection often being made to every third or fourth segment). The occasion for their use arises when it is desired to use many coils of thin wire, rather than half the number in thick wire. Consequently, they are used upon two-pole machines of high current output (say, over 200 amperes). And whenever the number of poles is insufficient to allow a simple lap winding to be used, the designer may be tempted to use a duplex lap. Better practice is to increase the number of poles so that the desired current may be taken from a simplex lap winding.

In spite of the supposed advantage that with a duplex winding only one half the current is being commutated at the brush tip at any instant, duplex windings are in practice liable to commutation troubles.

ANSWER TO CORRESPONDENT

H. TURNER.—(1) If you will inquire at the Patent Office, Southampton Buildings, London, W.C., they will give you the necessary forms for applying for a patent, and a list of the fees. You can also consult all existing patents at the library at the same address without charge. They are well indexed. (2) Mr. J. G. Lorrain, Staple Inn Buildings, High Holborn, W.C.; Mr. J. E. Raworth, 69-71 Queen Anne's Chambers, Westminster, S.W.; and Messrs. W. P. Thompson & Co., 285 High Holborn, W.C., are all reliable patent agents. (3) Whether it is a good time to exploit the patent depends on the subject. You must use your own discretion. (4) Good books are "A Handbook of Patent Law of all Countries," 2s. 6d., by post 2s. 9d.; "The Inventor's Adviser on Patents, Licenses, and Trade Marks," price 5s.

ELECTRICITY IN THE HOME

WITH this title Mr. G. Wilkinson, the Borough Electrical Engineer at Harrogate, has issued an attractively got-up booklet dealing with applications of electricity in the house. There is some interesting talk on the advantages of the rateable value tariff, which in Harrogate is a fixed annual payment equal to 15 per cent. of the rateable value of the premises, one quarter of which is invoiced quarterly, and $\frac{1}{4}$ d. per unit for all electricity consumed. For water heating and like apparatus having 100 per cent. load factor with automatic control, current is supplied on contract at $\frac{1}{4}$ d. per unit.

As showing the advantages of the tariff, an example is given of a house in Harrogate let at £60 per annum. In 1913 the kitchen range and boiler were removed, and the house was equipped as an "electric household" as follows:—Complete kitchen arrangement, including electric cooker and automatic electric hot-water apparatus capable of furnishing a maximum of 125 gallons of hot water (at 100° F.) in 24 hours. Eight rooms were fitted with plugs for electric fires, including four bedrooms and the bathroom. One fixed and three portable radiators were provided, as well as plugs for an electric vacuum cleaner on each floor. For supplementary heating in the cold weather a slow combustion coke boiler was installed in the basement, and hot-water radiators fixed in the entrance and rooms on the ground and first floors. In the coldest weather coal fires in slow combustion grates are used in place of the electric fires in the living rooms. These labour-saving improvements allowed of one maid being dispensed with, and the actual comparative expense, taking the average of two years, on the rateable tariff, showed a saving of £10 16s. 9d. per annum. At the same time, Mr. Wilkinson anticipates a substantial saving in current used for heating by the addition of automatic temperature regulators on the radiators.

Information is given on the various apparatus, and at the conclusion the names and addresses of the local electrical contractors are set out.

SCIENCE AND PRACTICE IN ENGINEERING

AT the opening of the present session of the Liverpool Engineering Society, Professor E. W. Marchant, D.Sc., delivered his presidential address on "The Relation of Science to Practice in Engineering." He emphasised Dr. Unwin's recent statement that it was to the application of scientific method that Germany held the position she had attained in engineering constructional work during the past twenty years.

As an instance of the effect of scientific study in one particular direction, the case of transformer manufacture was referred to. By the discovery of alloyed steel of high electrical resistance and good magnetic qualities, and by the scientific study of the most effective method of getting rid of waste heat, the cost of transformers during the past twenty years had been reduced from about £2 10s. to 10s. per kilowatt.

The value of laboratory research to manufacturing progress was enlarged upon. Whilst the laboratory had a limited scope in respect of the size of machinery it could deal with, and therefore limited functions in the field of research, nevertheless it had a definite place in this field. The work of laboratory research might be classified under three headings, the investigation of (1) the properties of materials, (2) the origination and design of machinery and apparatus, and (3) entirely new phenomena, with a view to their development for practical use. With regard to the first of these, the speaker dealt with the progress made in the manufacture of copper. Copper used nowadays was of 2 or 3 per cent. better conductivity than Matthiessen could produce in his laboratory. The presence of traces of such substances as arsenic or phosphorus had been found to reduce the conductivity of copper enormously. A most interesting example of the advantage of co-operation between the manufacturer and the physicist was given by the researches undertaken in Professor Barrett's laboratory at Dublin on the properties of iron alloys. These alloys, in which different substances such as tungsten, nickel, manganese, silicon, aluminium, &c., were alloyed with steel, were produced at the Hecla Works of Sir Robert Hadfield at Sheffield. These investigations led to the valuable discovery of the magnetic qualities of silicon and iron alloys of which "Stalloy" was one.

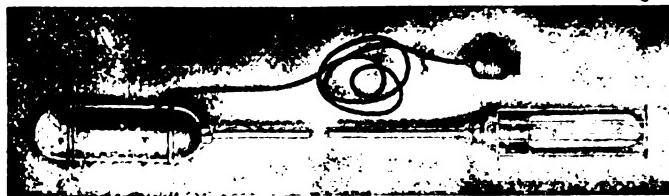
References were also made to the production of hard steel for magnets, and of manganese non-magnetic steel, to the investigations of the properties of insulating materials, and the improvement of transformer oil in the matter of sludging.

In connection with the investigation of machines and apparatus, the speaker referred to the building up of an individual magneto manufactory since the outbreak of war. This industry had been almost entirely in the hands of Germany, but as the result of a scientific design of magneto, the firm in question would soon be turning out from 1,000 to 1,500 machines per week, mostly for British and Allied Governments. Reference was also made to Professor Miles Walker's recent discovery of a new commutation device, by which the output of certain machines could be very greatly increased.

Professor Marchant said, in conclusion, that they must be prepared after the war was over for a fierce and unscrupulous war of commerce, not only with Germany, but with other countries less highly developed. They would have to make full use of their scientific knowledge, so as to save every penny they could of unnecessary expenditure in material or in labour.

A SHELL INSPECTION LAMP

NOT the least remarkable feature of modern shell construction is the minute care with which every part is inspected at each stage of its construction. One of the most important, and certainly one of the most awkward, of the inspection operations is that of examining carefully the interior of the shell, and to facilitate this operation the British Thomson-Houston Co., Ltd., of Mazda House, 77 Upper Thames Street,



E.C., have brought out the very workmanlike hand lamp shown in the accompanying illustration.

A stout brass wire guard with top and bottom plates forms a "squirrel cage" accommodating a tubular lamp $4\frac{1}{2}$ in. by $1\frac{1}{2}$ in. This guard, which can be removed if required, is carried in the usual manner by a bayonet lamp-holder mounted on a brass carrier rod. At the outer end of the latter is a boxwood handle, carrying a push-bar switch. The lamp is

supplied as illustrated, ready wired with 12 ft. of 35/40 work-shop flex to a coccus adapter. An important point is that where an ordinary electric light supply is not available, the new inspection lamp, equipped with one of the many types of Mazda miniature bulbs, can be worked from a low-voltage accumulator or even dry cells.

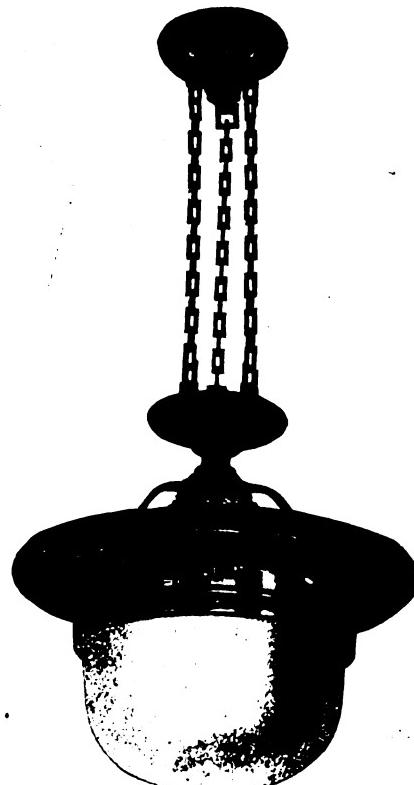
"SIMPLEX" HALF-WATT LAMP FITTINGS

THE introduction of the half-watt lamp has necessarily demanded a new type of fitting, and Simplex Conduits, Ltd. (Garrison Lane, Birmingham), have lost no time in designing some new patterns, of which we illustrate two. It is fortunate that the nature of the half-watt lamp enables fittings to



SHOP-LIGHTING FITTING.

be made more attractive in appearance than was possible with the arc lamp, and this applies equally to the inexpensive enamelled iron type for outside use as to the more elaborate designs for private house, shop, or public building lighting. In the designs illustrated, whilst consideration has been given



INTERNAL LIGHTING FITTING.

to appearance, much thought has also been given to mechanical suitability. Special care has been taken, both in the ventilating and weatherproofing of the outside lantern. The special glass used in more elaborate designs is the result of considerable experiments, and the aim has been to secure a maximum of light with the minimum of glare.

EDISWAN "ANTI-ZEP" SCREENS

WE illustrate an "anti-Zep" screen designed by the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex), to meet the shaded light regulations now in force in various parts of the country. Every attention has been given to its effectiveness and strength, only the best dark green sateen and trimming being used. Shades as well as screens are supplied.



EDISWAN "ANTI-ZEP" SCREEN.

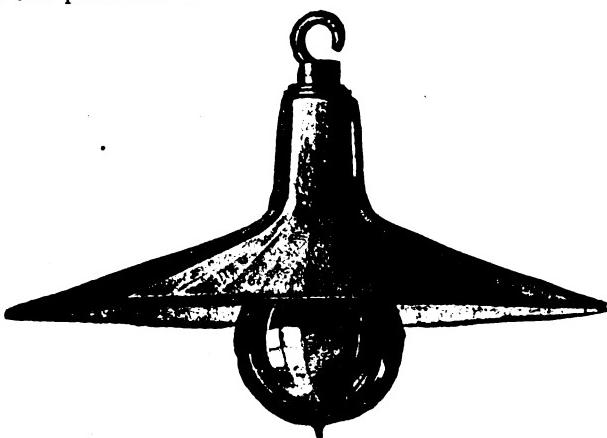
LIGHT AND MUNITION WORK

ONE of the most important points brought out in the report of the Departmental Committee on Factory Lighting was the enormous difference in output which experiments showed



MUNITION SHOP PENDANT.

could be effected by scientific artificial lighting. At present, when probably nine out of ten British factories are engaged in the production of munitions of war in one form or another,



HALF-WATT LAMP FITTING.

satisfactory lighting cannot be over-estimated. The general recommendations of the Committee were given on p. 378 of our issue for September 16th, but it cannot be emphasised too much that good artificial lighting increases output anything from 10

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.

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INDIA-RUBBER.

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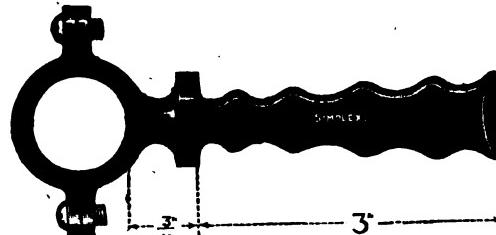
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to 20 per cent. It also reduces the risk of accident, and the tendency is for accident insurance companies to accept lower premiums in respect of premises lighted on really scientific lines. The change from rule-of-thumb methods to science is taking place rapidly in illumination, and, recognising this, the General Electric Company, Ltd. (67 Queen Victoria Street, E.C.), has established an illuminating engineering department to undertake research work and provide expert advice on all lighting problems. This department is fully equipped to design new lighting installations for every type of factory or workshop. It is also prepared to draw up schemes for improving existing installations.

At the same time, the Company is developing the manufacture of electric lamps and fittings, and, in addition to the Osram lamp and the later "Atmos" half-watt lamp, an extensive range of reflectors and fittings specially designed for factory purposes has been produced. We illustrate two types of these. Any factory owner who is dissatisfied with his illumination, or is uncertain whether it complies with the standard of efficiency which the Home Office Committee has defined, has only to seek the advice of the General Electric Co.'s new Department. The cost of a new installation or the re-arrangement of an existing one is trifling in view of the increased output which experience has shown to be possible as mentioned above.

A CONDUIT SPACING SUPPORT

THE conduit spacing support illustrated is intended for use in cases where conduits are run on the surface of brick, stone, or cement walls. The rag bolts should be well grouted into the wall, and the hole filled with Keene's cement



up to the shoulder. The conduit will then be spaced out a clear $\frac{1}{2}$ in. from the surface. Simplex Conduits, Ltd. (Garrison Lane, Birmingham), are placing these on the market at very reasonable prices.

CATALOGUES, PAMPHLETS, &c., RECEIVED

OSRAM PRICE LIST AND FOLDER.—The General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), has now issued its price list and folder bearing the picture of the gas-fitter, illustrated on page 449 of our November 4th issue. These the company is, as usual, willing to overprint for electrical contractors, dealers, and ironmongers.

"THE HOUSE BEAUTIFUL."—Under this title Ferranti, Ltd. (Craven House, Kingsway, W.C.), has just published a booklet in which is depicted the use of electric fires in all rooms in the house. The booklet is addressed mainly to those desiring to introduce all possible comforts and conveniences into their houses, but contractors will certainly find it of great assistance in facilitating business.

INDUSTRIAL LIGHTING FITTINGS.—A new leaflet has just been issued by the General Electric Co., Ltd. (67 Queen

Victoria Street, London, E.C.), dealing with a number of industrial lighting units suitable for use in different positions in factories and workshops—special attention having been given to ensure that the present lighting regulations are complied with.

"BRITANNIA" LAMP SHADES.—Messrs. Dick, Kerr & Co. (Abchurch Yard, Cannon Street, E.C.) is prepared to give free to applicants "Britannia" lamp shades which have been designed to comply with the present lighting restrictions. When in position they make an effective reflector and shade. The Company has also issued a home and export list of "Britannia" metal filament lamps setting forth prices, &c.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aberdeen.—The Electrical Engineer is to report upon extensions to the generating plant.

Australia.—The Sydneyp municipality requires a high-tension cable-testing outfit, consisting of a 350 k.v.a. single-phase transformer, a 175 k.v.a. single-phase potential regulator, a 1,600 k.v.a. single-phase inductance, and a control switchboard. Preference will be given to British manufacturers. Tenders by Nov. 22nd. This information is only of value to firms who can cable agents. A copy of the specifications may be seen at 73 Basinghall Street, E.C.

Downham Market.—The Council is considering a proposal by Mr. C. H. Best, of Bradford, to form an electric supply company for the district.

Edinburgh.—Estimates aggregating about £25,000 for water-softening plant at the new power-house have been submitted.

Fakenham.—Mr. C. H. Best, of Bradford, has been informed that the Council will not oppose his proposal to form a company to erect an electric supply works in the district.

Gravesend.—The Engineer reports the necessity for applying for further loans to cover mains extensions and house services during the next two years. The estimated cost is put at £2,500.

Huddersfield.—It is stated that in spite of the extensions which were installed a short time ago, the electrical undertaking is not able to cope with the private demands for power.

Pembroke (Ireland).—A Diesel engine and generator is required.

Salford.—An expenditure of £500 is contemplated upon mains and switchgear in connection with a supply to a local firm.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £91 10s. to £92 10s. (last week, £90 to £91).

Agencies.—The representative of a firm of machinery importers and agents in Melbourne, at present in the United Kingdom, is desirous of making arrangements to represent United Kingdom manufacturers of electrical machinery. Further particulars at 73 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

Mr. B. G. Lamme, Chief Engineer of the Westinghouse Electric & Manufacturing Co., Pittsburg, has recently been appointed a member of the U.S.A. Naval Advisory Board.



Mr. W. T. Roper, Manager of Messrs. Verity's, in Dublin, has been granted a commission in the Army Service Corps.

Mr. H. G. Barracough, Generating Engineer at the Hackney Electricity Works, has resigned.

An Electrical Mechanical Engineer is wanted for an Indian colliery. (See an advertisement on another page.)

LOCAL NOTES

Bradford: *Important Power Contract.*—The Electricity Committee has made arrangements to supply power to the extent of £20,000 per annum to new works which are to be constructed alongside the Midland Railway on land belonging to the Corporation.

Otley: *Electric Supply.*—The Council obtained an electric lighting Order in 1901, but although various schemes have been placed before it, nothing has been done with regard to a supply of electricity for the district. Now, however, an offer by the Electrical Distribution of Yorkshire to apply for an electric lighting Provisional Order has been accepted.

Southport: *Electricity Profits.*—There was a net profit of £2,213 on the electrical undertaking last year, an increase of £350 over the previous twelve months. The number of units sold increased by 340,000.

Tasmania: *The Hydro-Electric Scheme.*—A report by H.M. Trade Commissioner in Australia for 1914 records that the Tasmanian Government has entered into an agreement with the Hydro-Electric Power & Metallurgical Co. for the purchase of the electrical portion of its undertaking. At present some 26,000 h.p. can be generated for twelve hours per day, but this amount could be increased. Works which have been under construction for some time will be completed early next year. It is understood that the Tasmanian Government has offered to supply the Federal Government with power at £2 per h.p. per annum.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Edison & Swan United Electric Light Co.—After providing for debenture interest and depreciation upon freehold properties and plant there is a net profit of £14,147 for the year to June 30th, to which is added £5,732 brought forward. The directors propose to transfer £15,000 to reserve and to carry forward the balance. The necessity for creating a substantial reserve account is pointed to as the reason for the non-payment of a dividend. The increased turnover of the business, coupled with the rise in the cost of materials and labour, have severely taxed the capital resources of the Company, and the allocation to reserve is regarded as the only means of providing additional working capital. Whilst on the engineering side the extra cost of manufacture has been partially met by a corresponding rise in selling values, an increase in the selling price of drawn wire lamps is impossible. The export business, particularly to the British Colonies and India, shows a marked increase.

Drake & Gorham.—There was a net profit of £3,816 for the year to June 30th, after meeting bonuses due to staff, allowances to those who have joined the forces, and making provision for contingencies. A dividend of 2½ per cent. per annum is declared on the ordinary shares, goodwill is written down by £1,000, and a balance of £1,623 is carried forward.

At the annual meeting last week, Mr. B. M. Drake, the Chairman, stated that the Manchester office had shown disappointing results for the past year, the installation profits being less than a third of those of the previous year. Nevertheless, the amount of work in hand at the close of the year was largely in excess of the previous year's record. The country house lighting department has also been considerably affected by the war, but the wholesale department has held its own well.

The Osram v. Pope Patent Action.—The appeal of the Osram Lamp Works, Ltd., against the judgment of Mr. Justice Joyce, given on July 20th (ELECTRICAL ENGINEERING, July 22nd, p. 311), in which it was held that the process employed by Pope's Electric Lamp Co., Ltd., in the manufacture of their metal filament lamps, does not infringe the Just & Hanaman patent No. 23,899/04, was commenced on Thursday, before an Appeal Court, consisting of the Master of the Rolls, Lord Justice Warrington, and Lord Justice Bancks. The case will occupy a considerable time, and we will refer in greater detail to it in our next issue.

ELECTRICAL ENGINEERING

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THE ELECTRICAL ENGINEER
(Established 1884)

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Other Advertisement Rates on Application.

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SUMMARY

THE Manchester Engineers' Club has now formulated definite proposals for the organisation of the engineering industry. An association, on a non-trading and "non-interference-with-prices-basis," of British manufacturers in all branches of engineering is recommended (p. 468).

MR. Howard Foulds, Secretary of the Birmingham Corporation Electric Supply Department, in a Paper before the Birmingham and District Electric Club on Saturday, advocated the establishment of a Commercial Electrical Association (p. 468).

WE record the progress made by the Engineering Institutions' Volunteer Training Corps (p. 468).

IN his Presidential Address to the Institution of Electrical Engineers, Mr. C. P. Sparks advocated the abandonment of the principle of the lowest tender. The major part of the address consisted of an able review of the development of the electricity supply industry, marking very clearly the important steps in its progress and indicating the directions in which further advance might be anticipated (p. 469).

A PAPER recently read before the Indiana Electric Light Association emphasised particularly the value of electric vehicles as a means of filling up the hollow in the load curve which occurs during the midnight and early morning hours (p. 470).

AMONG the subjects of Specifications published at the Patent Office last Thursday were incandescent lamps, insulating compounds, carbon filaments, and vapour rectifiers (p. 471).

AT the Birmingham Section of the I.E.E. last night Professor A. B. Field read a Paper on "Some Difficulties of Design of High-speed Generators" (p. 471).

OUR Questions and Answers page this week deals with the best method of making a temporary alteration in the speed of a shunt motor (p. 472).

IN the Chairman's Address to the Scottish Local Section, Mr. D. A. Starr anticipates a busy time for the electrical industry after the war (p. 473).

AT the Newcastle Section of the I.E.E. on November 8th Mr. P. V. Hunter read his Chairman's Address on the design of power-station switchboards (p. 473).

PRACTICAL advice as to the running of storage batteries is given by Mr. R. Rankin in a Paper before the Association of Supervising Electricians (p. 473).

THE desirability of the formation of a Board of Industry, and a closer interest by the State in trade and technical education, were among the subjects discussed by Mr. H. H. Wright in his Chairman's Address to the Yorkshire Local Section (p. 474).

A VALUABLE collection of Papers left by Faraday was presented by one of his relatives to the I.E.E. last Thursday (p. 474).

NEW plant is required at Coventry (£30,278); a 5,000-kw. turbo-alternator at St. Pancras; mains at Islington and Woolwich; electrically-driven centrifugal pumps at Sydney (N.S.W.); and new generating plant at Bo'ness.—A quantity of telephone material is required in Australia (p. 475).

THE L.G.B. has refused to interfere with the development of the Barton power station of the Manchester Corporation (p. 476).

A SATISFACTORY year with Ediswan metal-filament lamps was reported at the annual meeting (p. 476).

For V.T.C. Orders and "Arrangements for the Week" see p. 476.

SUBSCRIPTION RATES.

The postage on ELECTRICAL ENGINEERING is unaffected by the new postal regulations, and the subscription for the United Kingdom is as hitherto, 6s. 6d. per annum, post free.

REDUCED SUBSCRIPTION RATES FOR COLONIES AND ABROAD.

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ORGANISATION OF THE ENGINEERING INDUSTRY.

AS we have already mentioned, the Engineers' Club of Manchester has had under consideration the present situation of the engineering industry and the best means for dealing with it, having regard to the position revealed by the war. On page 118 of our issue for March 18th we pointed out that a sub-committee had reported, and had made a certain number of recommendations as to future policy. Subsequently a special committee was appointed to consider the whole matter and report fully to the Club. A copy of this report has now been sent us, and in general it follows the recommendations of the sub-committee.

The Committee is convinced that the British engineering industry must organise without delay to take advantage of present opportunities and to meet the conditions which will follow the termination of the war, it being anticipated that our enemies, whose export trade has for the moment practically disappeared, will renew with increased fervour their characteristic methods of conducting a trade war against our industries. The proposed organisation, as we have already described it, is to be on a non-trading and "non-interference with prices" basis, comprising British manufacturing concerns in all branches of engineering. Such an Association, it is thought, would speak with a powerful collective voice in Parliament, would assist the Government in questions connected with industry and commerce, and would be entitled to representation on the governing bodies of universities and technical colleges. It is pointed out that the trifling subscription of one-tenth of 1 per cent. upon the £300,000,000 capital invested in the British engineering industry would provide an income of no less than £300,000 per annum. The general management of the Association would be in the hands of a competent business man under the direction of a representative and periodically elected council, the headquarters being in London or Manchester. The scheme provides for the establishment of branches at suitable centres in this country and others later on, the local representative being in close touch with the British Consul, the Commercial Attaché, the Colonial Governments, and the British Chambers of Commerce.

The scope of the Association is that already recommended by the sub-committee, although the classification is slightly different, it being now proposed to have standing committees in regard to the following departments, namely, General Purposes; Intelligence; Production; Inventions and Patents; Publicity; Finance; Education and Research; and Parliamentary.

This report was discussed by the members of the Manchester Engineers' Club on Friday, and it will be seen that if the scheme is to be adopted and worked practically, it would involve the disappearance of a large number of existing organisations, such as the B.E.A.M.A. and the British Engineers' Association, not to mention others. The scope of the recommendations is intentionally large and ambitious, because the Committee is convinced that half measures will not command general support. The aim is organisation of the whole engineering industry, so that it may help itself. Although the recommendations are the result of a year's discussion, not only by the Committee, but by many distinguished engineers and men of commerce, who have come from different parts of the kingdom to take part in the debates, yet one is bound to remind the Committee that the scheme is not only wide in itself, but practically involves putting all existing organisations of a similar character in the melting-pot and starting afresh.

A COMMERCIAL ELECTRICAL ASSOCIATION

AT a meeting of the Birmingham Electric Club on the 20th inst. Mr. Howard Foulds, the Secretary of the Birmingham Electric Supply Department, in a Paper upon "Organising the Electrical Industry," advocated the formation of a Commercial Electrical Association. He pointed out the disadvantages of having a large number of bodies dealing individually with work the major portion of which was common to all of them, and thought it would be infinitely better if there was one large Association for the protection and development of the commercial side of the electrical industry. All the existing bodies had the core of something useful, but none of them were doing anything which had a sufficiently important result upon the development of the applications of electricity to industry and commercial uses. What he was really anxious about was that we should establish a body which shall be *prima facie* a commercial association. The nucleus of such an association already existed in the B.E.A.M.A., but something more than this was required. We required in addition a strong association of supply undertakings, including the companies as well as the municipalities,

and further, a sound financial section, which would if necessary provide the funds for extending industrial undertakings. One of the most common remarks heard from the lips of industrial men in this country was that the banks do not support the trade of the country. It appeared to him, however, that it was the business of substantial industries to create their own financial institutions.

As an instance of the absence of organisation in the electrical industry at the present time, he instanced Birmingham. In that city there were some of the largest manufacturing companies in the electrical industry, and yet there was not an association to which anybody could go and say, "I want to know the electrical manufacturers of Birmingham. I want to know something about them, their particular lines of business, their status, and things of that kind." He might go to the Electric Supply Department and get some information there; he might look it up in the directory, or he might go to the Chamber of Commerce, but, in spite of the strength of the Birmingham Chamber of Commerce, which numbers 3,000 members, it had not an electrical section.

The proposed new association should consist of three main sections: (1) Manufacturing and contracting; (2) supply of electricity; (3) financial. Each section would have several sub-committees dealing with the different branches. In addition there ought to be a Benevolent Fund, and this would appeal to a much wider body than either the I.E.E. or the Electrical Trades Benevolent Fund; in fact, the latter might be taken over.

It was not, however, merely protection that such an association would ensure; it ought to have so wide an influence as to be able to carry through Parliament the very necessary amendments to existing Acts of Parliament, whose conditions hinder the development of the uses of electricity. It would stand immensely superior to any of the existing bodies or any temporary body perhaps created for some specific purpose. It was once said by a President of the Board of Trade that no Government is strong enough to resist the Association of Municipal Corporations. He believed, if we organised ourselves on a proper basis and found funds, it could be truthfully said that no Parliament would be a match for the Commercial Electrical Association.

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

THE first meeting of the General Committee took place recently, those attending including the Presidents of the Institutions of Civil, Mechanical, and Electrical Engineers, Sir John Gavey, Mr. J. S. Highfield, Col. Le Rossignol, R.E., Major Henrici, R.E., Capt. Sankey, R.E., Mr. L. B. Atkinson, Lieut.-Colonel C. B. Clay, V.D. (Commandant), and Mr. E. G. Fleming, Adjutant. An Executive Committee was formed consisting of Sir John Snell (retiring President of the Institution of Electrical Engineers), Chairman, Sir Maurice Fitzmaurice, C.M.G. (Vice-President of the Institution of Civil Engineers), Col. Le Rossignol, R.E., Lieut.-Colonel C. B. Clay, Mr. L. B. Atkinson (Hon. Secretary and Treasurer), Mr. E. G. Fleming, and a representative of the Institution of Mechanical Engineers to be nominated by the President.

The report of the Commandant as to the progress of the Corps was most encouraging. An arrangement has been made for sharing headquarters with the 4th Battalion City of London Regiment (Architects' Corps). The premises comprise a spacious drill hall with mess rooms, common room, orderly room, canteen, &c. Through the kindness of Mr. A. A. Campbell Swinton, F.R.S., the Corps has received a present from Messrs. Crompton & Co. of a new Admiralty pattern searchlight. This is being erected on the premises of the London Electrical Engineers (T.F.), where the necessary instruction will be given. Several men have already qualified in this branch, and parties are engaged each week-end on important work in connection with the defence of London.

In inviting suitable men to join the Corps, it is pointed out that only those who are over military age, or disqualified by reasons of health, or who are engaged on war work and not allowed to enlist in the forces, are acceptable.

Electric Power Stations and Munitions.—In the House of Commons last week Dr. Addison, speaking on behalf of the Minister of Munitions, said that it is hoped to deal with the question of taking over, as controlled undertakings, electric power stations and similar businesses essential to munition works in a Bill to be shortly laid before Parliament.

"The Central."—The last issue of *The Central* contains a Paper by Prof. W. E. Dalby on the recent extension of the City and Guilds Engineering College, read at last year's B.A. meeting in Australia, and a Paper on High Tension Power Transmission, read by Mr. B. Hague before the College Engineering Society. The Old Student Notes are particularly interesting at the present time. With the number a list of the past and present students known to be serving with His Majesty's Forces up to last May has been issued.

THE PRESIDENTIAL ADDRESS

Commercial Engineers, Lowest Tenders, and Progress in Electricity Supply

THE inaugural meeting of the new session of the Institution of Electrical Engineers was held last Thursday. After the presentation to the Institution of the Faraday Papers, reported elsewhere in this issue, and the distribution of the premiums and prizes awarded at the end of last session (a list of which was published in ELECTRICAL ENGINEERING of May 20th, p. 213), Mr. C. P. Sparks, the new President, delivered his Address.

After 15 months of war on an unprecedented scale, he said, the present need is not less urgent: the last recruit and the last round of ammunition will be the deciding factor. While the bulk of our 7,000 members are engaged in maintaining the public services or, directly or indirectly, the manufacture of munitions of war in comparative safety, our hearts go out to the 1,150 members of the Institution who are on active service in answer to the national call.

As one-half of my career has been spent in the manufacture of electric supply plant, and the other half as engineer to electric supply undertakings, Mr. Sparks continued, I desire to say a few words on a subject of special interest to all sections of the Institution. It is sometimes suggested that commercial matters should not be dealt with by engineers, who should confine themselves to technical questions. I disagree with this view, and believe that the commercial engineer is just as much a recognised member of our profession as a pure scientist. Now, as to the acceptance of the lowest tender, whether it be British or foreign, it must always be remembered that the onus of development and the successful carrying out of a contract is borne by the contractor, and that if a reasonable margin of profit is not secured, the contractor cannot in the long run do his duty by the purchasers. First, the contractor is crippled, being unable to make provision for development, since without profit new capital cannot be attracted; but, what is more serious, provision cannot be made for improvements, without which we cannot keep pace with our world competitors. The national interest would be better served by encouraging private enterprise to develop invention, by allowing manufacturers a reasonable margin of profit, than by securing—for the moment only—slight fractional reductions in the cost of public service undertakings through acceptance of the lowest tender, which is not always necessarily the most favourable.

Mr. Sparks then followed the example of many previous Presidents in reviewing the position of the section of the industry in which he has been most closely associated, and gave an extremely interesting sketch of the development of electricity supply, particularly in relation to London itself.

He recounted the early history of electric lighting in London, and mentioned how development had been seriously retarded by splitting up the Metropolis into many areas, by making it more or less essential at first for traction undertakings to erect independent generating stations, by the treatment of the London Electric Supply Corporation in refusing its powers for bulk supply in 1888 and allowing competition in its main area, and by the rejection by Parliament of the Merz bulk scheme in 1905.

Some interesting tables showed how electricity supply had developed in London notwithstanding. In the area of 117 sq. miles covered by the metropolis, 334,442,700 units were sold in 1914, as compared with 14,206,900 in 1894, the revenue for the sale of electricity had increased from £352,830 to £2,742,400, and the average revenue per unit had decreased from 5·96d. to 1·97d. The capital expenditure up to 1914 was £21,813,500—about one-third by local authorities, and two-thirds by companies—and the average density of the sales (apart from traction) is 3 million units per annum per sq. mile, reaching 45 units per sq. mile in the area of densest demand. Another interesting figure was that, in spite of the introduction of metal filament lamps, the sales during the past ten years had increased at the rate of 20 million units per annum, compared with an increase of 12 million units per annum for the previous ten years.

The inefficiency from the engineering point of view is brought out by the statement that there are no less than 38 separate supply and traction undertakings in the 117 sq. miles, involving 48 power stations and 9 different frequencies of alternating current. Although reliability of supply is of the first importance and of far greater importance than the provision of a supply at a minimum cost, yet adequate safety could be secured with far less than the present number of power stations; and as most of the individual undertakings are being supplied by a single power station unconnected with any other undertaking, the general safety of supply would be improved if the separate undertakings were interconnected and supplied from a suitable number of modern power stations, each capable of dealing with demands of not less than 100,000 kw. A commencement, Mr.

Sparks suggests, could be made with one station to supplement the supply from existing stations, and as the less efficient of these passed gradually out of use, the main power station would be supplemented by a second or further stations as required.

Mr. Sparks then reviewed the improvements to which progress in electricity supply had been primarily due. Before the discovery of the 3-phase system by Galileo Ferraris and Nicola Tesla between 1885 and 1888, and its development by C. E. L. Brown and Dobrovolski, no transmission system was available capable of giving a general supply for all purposes. The economy in the first cost of 3-phase generators and transmission mains, and the ease of transformation of alternating currents by static transformers, combined with the invention of the induction motor, provided a system which enabled one undertaking to serve every class of demand in a large area. In the original alternating-current systems in this country, started for lighting supply, frequencies of 80 to 100 cycles per second were selected to keep down cost and to raise the efficiency. Although not recognised at the time, the choice of these high frequencies made the development of single-phase alternating-current motors almost impossible. Long before any general change took place in this country, low frequencies had been adopted by C. E. L. Brown in Switzerland for low-speed generators driven by water power, and by Ziperowski, who developed low-speed alternators direct-coupled to reciprocating engines. Although 50 cycles has now been adopted as the standard frequency of supply for all purposes outside special transmissions or single-phase railway work, the effect of developing alternating-current systems on a wrong basis has not yet been eradicated.

The theory of the parallel working of alternators was described by Mr. H. Wilde in 1868 and by Dr. Hopkinson in 1882 (following his tests on the parallel operation of de Merit's magneto machines, which were worked in parallel or run as synchronous motors), but the general parallel working of alternators was a matter of difficulty up to 1889, and was only seriously developed after the reading of Mr. W. M. Mordey's Paper on the subject before the Institution that year. Mr. Mordey had then also shown the possibility of converting single-phase alternating currents into continuous currents by the use of synchronised motor-generators.

The development of the steam turbine, due to Sir Charles Parsons, together with the adoption of superheated steam and suitable condensing facilities, had entirely changed the character of supply undertakings, by increasing the possible size of operating units, reducing the cost of generating and boiler-house plant and buildings, and lowering the operating cost. When an ample supply of cold condensing water is available, modern condensing plant is capable of maintaining a vacuum of 97 per cent. (29 to 30 in. vacuum) of the theoretical value in the turbine casing, as compared with the 25 to 30 in. vacuum (85 per cent.) normally used with reciprocating engines. The use of turbo-generators enables a watt-hour to be generated in large power stations supplying diversified demands for 20 to 25 B.Th.U. (say 1½ to 2 lb. of average coal per unit), as compared with 100 to 150 B.Th.U. (or 8 to 12 lb. of average coal per unit) originally used in the small stations using non-condensing reciprocating engines supplying lighting demands.

In the early days of the industry the average size of the generator in lighting stations was 100 kw., generators rated at 500 kw. being exceptional. The maximum size of turbo-generators is not yet in view; machines rated at 30,000 and 35,000 kw. and made by the General Electric Company (U.S.A.) are at work, while machines of still larger capacity are being designed. The upper limit in the size of generators is at present fixed by the extent of the system to be supplied and the limitations of the method of control, rather than by any limitations in design.

The main improvement in steam-raising is the universal use of large water-tube boilers, in which the superheater and economiser form an integral part, on normal output each boiler evaporating up to 50,000 lb. of steam per hour at 200 to 250 lb. per sq. in. pressure, the steam being superheated 200 to 250° F., as compared with boilers evaporating 8,000 to 10,000 lb. of steam at 80 to 150 lb. pressure.

Great progress has been made in furnace design and in mechanical stokers, thereby enabling small coal of comparatively low calorific value to be efficiently and smokelessly burnt. This has resulted in the average efficiency in conversion of the heat energy of the coal being raised from 65 to 85 per cent. on test and from 50 to 75 per cent. under operating conditions, with a material saving both in the cost of fuel and in labour. Instead of duplicate steam ranges of cast iron, with copper bends, single steel mains are used, while the continuous flow of steam required by turbines, as compared with the intermittent flow of steam with reciprocating engines, has further reduced the area of steam pipes exposed to condensation. The increase in size and the improved design of water-tube boilers and accessories have resulted in the space occupied by the boiler-house plant being reduced to one-fifth of that required for an equal evapo-

tion of steam 30 years ago. Through the introduction of turbo-driven machinery, which requires no internal lubricant, the durability of the boiler plant has been much improved.

The invention and development by Mr. Ferranti of the paper-insulated lead-covered cable not only reduced the cost of transmission and distribution, but has largely increased the reliability of operation.

No conversion of alternating current to continuous current by rotary converters was possible in the early stages owing to the want of an alternating-current motor. Rotary converters were first developed some 25 years ago in the United States for supplying traction systems, a frequency of 25 being standardised for transmission. It was not until 1905 that satisfactory 50-cycle rotary converters were developed. This was rendered possible by the introduction of interpoles, which allowed higher speeds to be used, thus securing reasonable spacing for commutation. The development of the 50-cycle rotary converter has resulted in reducing the space occupied by transforming plant to one-half of that required by motor-generators; the first cost has been reduced to between one-half and two-thirds, and the efficiency of conversion has been raised to 94 per cent. at full load.

Metering was a great difficulty in the case of early undertakings. The first meter developed for continuous-current supply was of the electrolytic type. No meters were available for alternating-current systems, and electricity was sold by annual contract. As an instance of close calibration and accuracy of present-day meters, Mr. Sparks gave the reading of three motor meters, the power factor of the supply varying from 0·8 to unity and the demand from 2·5 to 60 per cent. of the rated capacity of the meters.

| | Meter (1) | Meter (2) | Meter (3) |
|----------------------------|-----------|-----------|-----------|
| Number of units registered | 1,955,700 | 1,945,800 | 1,952,300 |
| Percentage error from mean | +0·23% | -0·28% | +0·05% |

The introduction of the metal filament lamp was, of course, one of the greatest advances. In addition to the 3-fold efficiency, another important result is that the lamp is much less sensitive to fluctuations in pressure. In the case of carbon filament lamps the statutory permissible voltage variation of 4 per cent. means that the light varied between -20 and +25 per cent. With the same pressure-variation and the metal-filament lamp the limits are -14 and +16 per cent. With the half-watt lamp, the variation is further reduced to 12 per cent. + or -.

The high efficiency of conversion from electric to mechanical power in the motor as originally developed left little room for improvement. The main efforts of designers have been devoted to reducing the weight and thus lowering the cost, which has fallen 50 per cent. in motors of moderate size during the last 15 years. The development of the induction motor, with its advantages of close speed-regulation and absence of commutation, has been largely responsible for electric driving being used in many industrial concerns in preference to other forms of power.

In the concluding part of his address, Mr. Sparks reviewed the direction in which further progress might be expected. He pointed out that the economical use of fuel has been hindered in this country by its low price, and that fuel is being used wastefully to the prejudice of future generations. Only a fraction of the total coal consumed is at present used for centralised source of supply of power and heat, the principal future economy in fuel is to be found in increasing this proportion. In the absence of any prospect of the development of an economical system of storage for electricity, which would at once raise the present load factors of from between 25 and 35 per cent. to nearly 100 per cent., and thus materially lower the cost of generation, or until some new method of converting the heat energy of coal to electricity is discovered, one of the next steps to lower the cost of production of electricity will be the gas-firing of boilers, the gas being obtained from producers worked at a low temperature. This will provide by-products from the distillation of the coal as a raw material for other industries. The sizes and positions of most of the present power stations prevent this system being used, as by-product processes can only be successfully worked on a large scale and with plant operating at a high load factor. It is also certain that electricity will prevail more and more as an illuminant owing to the greater number of candle-power-hours that can be obtained from a ton of coal by using electricity as compared with gas. With electricity generated in modern power-houses using a 25 B.Th.U. per watt-hour, and with 85 per cent. efficiency of distribution, the number of candle-power-hours obtained per ton of coal is with ordinary metal-filament lamps of 15 to 20 candle-power, no less than 750,000 as compared with 260,000 in the case of gas, gas mantles of 20 candle-power and 13,000 cubic feet of gas per ton of coal carbonised being assumed. Further research should result in improved dielectrics which would allow higher working pressures for underground cables, thus lowering the cost of transmission, increasing the size of each centralised undertaking, and again raising the operating load factor by the greater diversity in the demand.

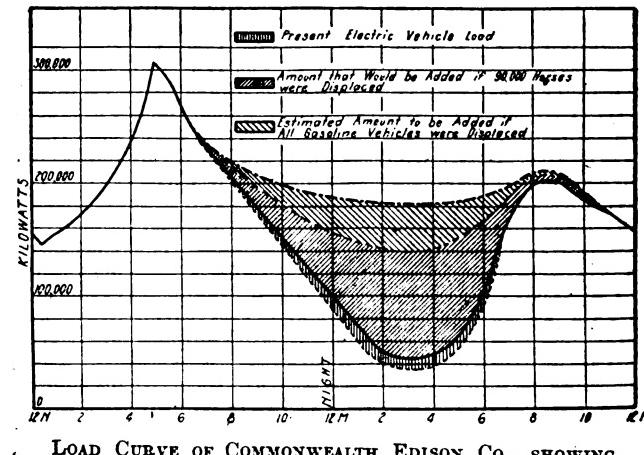
Pending this development, the economical radius of transmission can be increased by using overhead lines outside the thickly populated districts.

Lastly, Mr. Sparks referred briefly to electric cooking and heating. While on the one hand it is only possible to deliver to consumers some 15 per cent. of the heat energy in the coal, regard must be had to the low-efficiency when coal or gas is burnt direct, owing to the necessity of getting rid of the products of combustion. This low efficiency allows electricity to compete successfully for all intermittent uses. The present cost of the apparatus and its maintenance should be reduced by a large expansion of business, as soon as the supply undertakings are prepared to let on hire and maintain apparatus on liberal terms in the same manner as the electric motor business was developed. Low price per unit is also justified for this class of supply by the high diversity factor and the large number of hours of use, resulting in a greatly improved load factor from the residential demand.

EFFECT OF ELECTRIC VEHICLE CHARGING ON THE LOAD CURVE

At a recent convention of the Indiana Electric Light Association Mr. Q. A. Brackett read an interesting Paper on the characteristics of the battery-charging load of electric vehicles. Much has already been done towards increasing the off-peak day load by pushing the sale of electric heating and cooking appliances and the development of the motor load, but much remains to be done in filling in the light load period between midnight and morning. For this there is nothing so well suited as the charging of storage batteries; it can be made to fill up the worst hollow in the load curve during the small hours of the morning; it is a long-continued load, not a fifteen-minute one like cooking devices; it should become a regularly recurring load and frequent, occurring practically every night; it is a comparatively heavy load, usually many times greater than the average lighting load; and it is a steady load of good power-factor, and is not subject to sudden changes like a motor load.

Mr. Brackett emphasised that the first thing that a central station must do to increase the use of electric vehicles in its territory is to make special rates for power when used for



LOAD CURVE OF COMMONWEALTH EDISON CO., SHOWING IMPORTANCE OF BATTERY-CHARGING LOAD.

off-peak charging, and advertise this fact conspicuously. The second step should be to educate the public as to the advantages of the electric vehicle and its real economy over other types by continuing the policy now being adopted by central station electrical vehicle enthusiasts in this country by using these vehicles themselves and securing their adoption by other municipal departments.

For a number of years, said Mr. Brackett, a commercial electric vehicle has always meant a fairly large and expensive chassis, which only large concerns dealing in heavy merchandise would buy. Lately, however, light electric delivery vans, costing below £200, have appeared on the market, and these open up a new field for the application of electric vans to the delivery service of bakeries, grocery and provision stores, light express services, &c., where the one-horse van is so common to-day.

The author showed a load curve, which we reproduce. It represents graphically the vast improvement capable of being effected to the load of a central station by the addition of battery charging for electric vehicles, and incidentally also the limited progress that has so far been made by the Company in question. It must not be forgotten, however, that our municipal electricity works should have considerable advantage over a company in being able to bring about more readily the utilisation of electric cars in the other departments of the Corporation, which, as has already been mentioned, is the best advertisement to the public.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Nov. 18th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

16,850/14. **Incandescent Lamps.** H. G. FINCH (LORD GUERNSEY) and J. F. POYNTER. Metal filament lamps with helically-coiled filaments arranged in star form on a series of supports, those at the inner angles of the star being in a plane nearer the neck of the lamp than those at the points. (Two figures.)

24,419/14. **Insulating Compound.** B. T.-H. Co. (G.E. Co., U.S.A.). A moulded compound made by thickening china wood oil mixed with asbestos fibre, ground marble, and carbon black by heating.

4,776/15. **Carbon Filaments.** SIEMENS & HALSKE A.G. Filaments or rods composed mainly of graphitised carbon are made by depositing carbon on a tungsten core, heating in an electric furnace to a temperature equal to or above the melting point of tungsten, and subjecting to high pressures. (One figure.)

8,173/15. **Vapour Rectifiers.** BRITISH WESTINGHOUSE Co. A vapour rectifier system for converting A.C. to D.C. for traction, in which several rectifier units are grouped in conjunction with tappings on a transformer with suitable switchgear to enable a variable voltage to be obtained. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: ROUTIN [A.C. motor group control] 4,079/14.

Instruments and Meters: LINCOLN [Thermal meters] 21,792/14; HOLDEN [Moving coil instruments] 23,071/14; BOOTH and MILLER [Prepayment meters] 937/15.

Switchgear, Fuses, and Fittings: B. T.-H. Co. (G.E. Co., U.S.A.) [Electromagnetic switches] 23,544/14.

Telephony and Telegraphy: SHEPPARD and McKECHNIE [Line or wireless telegraphy] 20,319/14; BRITISH INSULATED & HELSBY CABLES, LTD., FULLER and HARRISON [Duplex telephony] 22,554/14; GREENWOOD [Telephone receivers] 22,887/14; PARKER [Telegraph wire joint] 757/15.

Traction: MIDGLEY and VANDERVELL [Electric engine starters] 23,357/14; ÖSTERREICHISCHE DAIMLER-MOTOREN A.G., 9,682/15.

Miscellaneous: RICCI and RICCI [Portable head lamps] 1,689/15; F. BARKER & SON, LTD., and BARKER [Magnetic compasses] 1,818/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Switchgear, &c.: SOC. GÉNÉRALE DE CONDENSATEURS ÉLECTRIQUES [Excess voltage protection] 15,148/15; GILES [Excess voltage protection] 15,196/15.

Opposition to Grant of Patent

A grant of a patent has been allowed on the following application in spite of opposition:—

6,900/13. DORMER. Relays for automatic signalling actuated by superposed A.C. and D.C.

The following are the more important Patents that have become void through non-payment of renewal fees.

DYNAMOS, MOTORS, AND TRANSFORMERS: V. LOWENDAHL [Brushes] 17,002/02; DEUTSCHE-ELECTRISCHE SPARLICHT GES. [Reducing transformers] 17,761/09.

Electrochemistry and Electrometallurgy: AKTIEBOLAGET ELEKTROMETALL [Electric furnaces] 17,342/09.

Incandescent Lamps: D. ASSERSONH [Tubular lamps, reflectors, &c., for strip lighting] 17,855/07.

Switchgear, Fuses, and Fittings: L. M. WATERHOUSE [Resistances] 17,196/02.

Miscellaneous: D. MAGGIORA and J. M. SINCLAIR [Electrically-driven gramophones] 17,864/09; M. KAROLYI and C. BERGER [Electrical control apparatus actuated by sound waves] 17,932/09; SIEMENS BROTHERS & CO., LTD. [Electric clocks] 18,005/09.

DESIGN OF HIGH-SPEED GENERATORS

At the Institution of Electrical Engineers in Birmingham last night Prof. A. B. Field read a Paper on "Some Difficulties of Design of High-Speed Generators." The Paper will be read in London to-night.

The author based his remarks chiefly on the example afforded by a particular machine—a turbo-generator of 20,000 k.v.a., 3-phase, 4-pole, 60-cycle, 13,200 volts, with a rotor measuring 51 inches by 75 inches. He pointed out first that there was the problem of constructing a rotor weighing about 60,000 lbs., and with a peripheral speed of 24,000 ft. per minute, the centrifugal force on a 1 lb. mass at the periphery being about 1 ton.

In discussing the method and material of rotor construction, it was shown that the nature of the stresses in turbo-rotors is different to that occurring in similar forgings for general engineering purposes. In the former there are large radial stresses reaching down to the centre, whereas in the latter the stresses are chiefly longitudinal and near the surface. To meet these difficulties in the case of large, high-speed, waterwheel-driven generators, one firm had used open-hearth rolled plates consolidated and mounted on a shaft. Compared with rolled plates there is probably no other form in which such large masses of steel can be produced at a low cost having such good physical properties in directions of two dimensions. The impossibility of using a central shaft, however, for the largest turbo-rotors, introduced a serious difficulty, and it was due to the suggestion of Behrend that the feasibility was demonstrated of constructing such a rotor with the plates slightly rabbeted into one another, and into a flanged shaft at each end. With this construction, with 4 or 6 chrome-nickel steel bolts each of 4 inches diameter, a 50- to 56-inch diameter rotor can be constructed with practically the solidity of a single piece.

The question of critical speed was next discussed. It is believed to be an advantage to keep the critical speed above the running speed when this is feasible, and this considera-

tion affects the proportions of the whole machine. The rotor body has to be short, which means a high gap density and severe working of the stator material in the neighbourhood of the gap. The shaft diameter must be large, hence high peripheral speeds must be tolerated for journals and slip-rings.

On the subject of ventilation of rotors, the author stated that it is extraordinary how large a rotor loss can be dissipated merely from the drum surface with no ventilation, and that it is commonplace knowledge how little good some fairly elaborate ventilation systems are found to do. He described in detail a simple and effective system of ventilation to which the plate construction of rotor specially lends itself. It consists essentially of axial vents beneath the slots, with radial discharge openings cut out between the plates before the latter are assembled.

The matter of the support of the rotor windings against centrifugal forces, and forces caused by short circuits, was entered into. For the support of the slot portion of the winding, special wedges were described, and the question of retaining rings for the support of the end-connections was discussed at considerable length. In rotors of this size mechanical considerations must take precedence over everything else, hence weldless chrome-nickel steel is used for these end-rings, in spite of magnetic difficulties being introduced.

Although the construction of rotors forms the main theme of the Paper, the subject of stator construction was also treated at some length. The arrangements for stator ventilation and mechanical support of the windings to stand severe short circuits were discussed. With regard to the latter the author said that it was now considered necessary to build these large machines so that they could be dead short-circuited at their terminals when running excited and giving full voltage.

The Paper was concluded with a description of a special type of "magnetic wedges" which were inserted in large stator slots, to overcome the difficulty encountered of considerable rotor face losses occasioned by large open stator slots and comparatively small air-gaps.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,470.

We have occasion to make good welded joints in copper wires of all sizes, from the smallest up to $\frac{1}{8}$ in. square. Would a "welding transformer" be suitable for this? If so, what is the arrangement made for adjusting the current to the right value for various sizes of wire?

(Replies must be received not later than first post,
Thursday, Dec. 2nd.)

ANSWERS TO No. 1,468.

I have a D.C. motor rated at 20 h.p., 950 r.p.m., which drives some line shafting for machine tools. It is a 220-volt, 4-pole, shunt machine, with lap-wound armature, and has good commutation. I wish to increase the normal speed to 1,100 r.p.m. for special work during the war, and then to reduce it again to its normal value. What is the most economical way of doing this?

The first award (10s.) is given to "Alpha" for the following reply:—

There are two ways in which the speed of a shunt-wound motor can be readily increased:—

(1) By increasing the air-gap between pole face and armature.

(2) By reducing the field current.

I suggest that in the present case the inquirer should first slack off the bolts holding one of the main poles in the frame, and see whether there are any thin iron shims behind the pole. If so, these should be removed from behind all the poles, and the bolts tightened up again. If this increases the speed of the motor too much, thinner shims of soft sheet-iron should be substituted for those taken out. Assuming normal values for the air-gap length and the saturation curve of the motor in question, it is probable that an increase in the length of the air-gap of about $1/32$ " will give somewhere near the required speed. It is impossible to give more definite figures without full particulars of the design of the motor, but if there are shims behind the poles the matter can easily be settled by experiment as described above. The shims taken out can be kept and replaced when the motor speed is required to be reduced to 950 r.p.m. again. The cost of this method would only be the man's time in removing the shims.

If there are no shims behind the poles, it would be possible to increase the gap by grinding back the pole faces or by increasing the bore of the frame, but it would be simpler and cheaper in this case to reduce the field current by connecting a resistance in series with the shunt winding. The makers of the motor would doubtless supply a suitable resistance, all they would require to know being the particulars given on the name-plate (particularly the serial number of the motor) and the amount of speed increase required. If for any reason they cannot be communicated with, an ammeter and a variable resistance should be connected in the shunt-field circuit, the resistance being variable from 0 to, say, 150 ohms, with a current capacity of about 2 amps. The particulars required are the terminal voltage, the shunt-field current taken by the machine with no resistance in circuit, and the shunt-field current, with such value of resistance as

will give the required speed. The test should preferably be taken with the motor warm, i.e., after not less than three hours' run on normal load, and could be carried out in a few minutes by any competent local electrician. From the figures obtained any manufacturer of electrical control gear could make up a suitable resistance unit. No sliding contacts or switch would be necessary, the resistance being merely connected in the field circuit and left there until it is desired to reduce the motor speed to 950 r.p.m., when it can be disconnected. The cost of the resistance would be about 10s. or 15s., to which would be added the man's time in making the necessary test and connecting up the resistance.

As the commutation of the motor is good under present conditions, it is not likely that it would be materially affected by the proposed increase in speed if the machine has commutating poles. If not, it is possible that the operation would be impaired, since the h.p. will presumably be increased at least in proportion to the speed. If it is, the brushes can be given a little more backward lead, and this will probably put matters right. It should not be necessary to adjust the brush position if the motor has commutating poles, but the effect of a small movement forward or backward may be tried if the operation is bad. The best position with commutating poles will be found to be on the neutral point.

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The two methods of increasing the speed of a shunt motor are either to increase the length of the air-gap or to increase the resistance of the shunt circuit, the effect in both cases being to decrease the flux. The increased air-gap is generally obtained by taking out the "liners," or thin sheets of iron, that are placed at the back of the pole-cores or of the pole-shoes; but the thickness of these sheets is exceedingly seldom sufficient to give the 16 per cent. speed variation required in the question. Since the commutation at the present speed appears to be good, it will be simpler and more economical to get the whole of the speed variation by decreasing the shunt current. A rough approximation of the value of the extra resistance can be found thus:—

The normal loss in the shunt winding of a 20 h.p. 950 r.p.m. protected type motor is about 500 watts, so that the corresponding shunt current is 2.3 amperes. The magnetisation curve for the machine is not given, but taking values off a typical curve for such a motor, the shunt current must be decreased to about 0.73 of its normal value in order to decrease the flux sufficiently to give 16 per cent. increase of speed. Hence the shunt current at 1,100 r.p.m. is $0.73 \times 2.3 = 1.68$ amps.

The resistance of the shunt circuit for 950 r.p.m. is about $\frac{220}{2.3} = 95.6$ ohms, and the new resistance is $\frac{220}{1.68} = 131$ ohms, so that the resistance of the shunt circuit must be increased by 35.4 ohms. The writer would therefore suggest that a resistance of about 40 ohms capable of carrying 3 amperes (this being approximately the current when the machine is cold) should be connected in series with the shunt winding. Should this be a little too much, it is an easy matter to cut some of it out. When the speed is to be reduced to its original value, all that need be done is to remove or short-circuit the extra resistance.

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The greater portion of the address was a review of the multifarious applications of electricity in all spheres of action in the war, but towards the end Mr. Starr went into a little detail as to how the electrical industry as a whole is going to be affected when the war is over. It is, he said, very difficult to forecast what may happen, but a few points which occurred to him might be worthy of consideration. It was almost certain that there would be a reduction in the supply of electrical energy required for munition work, many power contracts having been made for the duration of the war only. It would take some time to re-organise industrial works temporarily equipped for this class of work, and to restore the plant to normal industrial capacity. On the other hand, it was quite possible that a great many manufacturers will find new markets for their products both at home and abroad. During the war our shipyards have been almost invariably engaged on war material. A great many ships have been rendered useless for their original purposes through being stripped of their fittings and converted into armed cruisers, transports, &c. The shortage of merchant ships consequent on German submarine activities must to some extent be made up, and it was therefore reasonable to expect that ship-builders and a great many engineering concerns dependent on the subsidiary work in connection both with naval and mercantile shipbuilding and ship repairing would be exceedingly busy. The restrictions placed on the export of coal would be withdrawn, and the output of the collieries should be consequently increased.

Opportunities, too, would be afforded to British manufacturers to obtain a firm footing in markets all over the world, which hitherto have been entirely in the hands of the Germans, and if these opportunities were grasped an increase in the number of industrial factories might be looked for. Naturally, money to finance new projects would be both scarce and dear, but making allowances for these we should be in a better position than our enemies or allies. This was a subject which should engage the most thorough consideration and attention of the personnel of the electrical industry in common with that of other British manufacturers.

Another matter which Mr. Starr dealt with to some extent was the cost of production, in which the two items entering very largely were, he said, coal and labour. He drew attention to the fact that the present prices of coal, compared with 1911 and 1912, show an increase of nearly 100 per cent., as far as the West of Scotland is concerned, and looked at from the power producers' point of view the remedy was to have a coal clause in all contracts with consumers. As regards labour, he strongly condemned the agitation which has been going on since the war started for increased wages, and he felt sure that all true patriots would have welcomed, either at the time war was declared or shortly afterwards, a Royal Proclamation putting every man, woman, and child in the country under martial law.

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A number of diagrams of bus-bar connections in power stations were exhibited with the object of showing the difference in the extent to which they provide against internal breakdown of the switchboard. He demonstrated that multiplication of parts, designed to provide against breakdown, may actually prove conducive to breakdown, and considered that in general it would be preferable to spend money on apparatus having larger provision against accident, than in resorting to a more complicated arrangement.

He then entered into a discussion of the more common kinds of trouble met with in switchgear, referring to mistakes of staff, such as opening the isolator of a feeder carrying load instead of the one next to it; unforeseen effects, as, for instance, the abnormal mechanical forces occurring on short circuits; and weakness or deterioration of apparatus, this, however, being of rare occurrence. He considered that perhaps undue faith had been placed on the use of reactances for meeting severe conditions, and that the possibility of oil-switches for opening even heavy short-circuits had been overlooked.

In conclusion, the Chairman said that experience led him to the view that it would be a mistake to attempt to standardise switchboard arrangements or switches.

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A THOROUGHLY practical Paper on storage batteries was read before the Association of Supervising Electricians by Mr. R. Rankin on Tuesday, Nov. 2nd. In the choice of a battery, he said, the most important point is to get it large enough. Having got the large battery, there are important things to remember in connection with the first charge. A continuous 24-hour run is essential for this, and it does not do, therefore, to make this charge the first trial of the generating plant. The latter should be well tested before the cells are filled with acid; then they should be filled and the charge started as soon as this is completed. The initial specific gravity of the acid is usually about 1.200 at normal temperature. In giving the first charge, only about two-thirds the normal charge rate should be followed, which is, in general, roughly equal to the 7-hour discharge rate. During this charge the temperature of the cells should be observed, and if it rises above 100° F., the charging current should be reduced to keep the temperature below this value. The specific gravity will first drop and then rise, and the voltage, of course, will gradually rise, and charging should be continued until there is no increase in either for about six hours. It is wrong to assume that the first charge is complete when a certain voltage or specific gravity is reached, or when the plates assume a good colour, or when they are gassing freely, or merely after a definite number of hours. With regard to constancy of specific gravity, however, it may be noted that if the temperature is rising, the specific gravity may decrease. A correction of one point for every 3° F. above 60° F. may be applied.

As soon as the first charge is completed the battery may be put into commission, but it will usually be necessary first to adjust the specific gravity of some cells and level of the electrolyte in all the cells, and at first also a generous amount of excess charge should be given after each discharge.

The Paper contains the following useful table, giving the relative capacities, corresponding currents, and final voltages at different discharge rates:—

| Duration of discharge (hours). | Capacity in terms of maximum | Rate of discharge in terms of 10-hour rate. | Final P.D. (volts.) |
|--------------------------------|------------------------------|---|---------------------|
| 10 | 1.00 | 1.00 | 1.83 |
| 9 | .98 | 1.09 | 1.83 |
| 8 | .95 | 1.19 | 1.83 |
| 7 | .92 | 1.31 | 1.83 |
| 6 | .88 | 1.46 | 1.83 |
| 5 | .83 | 1.67 | 1.83 |
| 4 | .78 | 1.95 | 1.80 |
| 3 | .72 | 2.39 | 1.80 |
| 2 | .63 | 3.17 | 1.78 |
| 1 | .50 | 5.00 | 1.75 |
| .75 | .45 | 5.84 | 1.70 |
| .5 | .37 | 7.45 | 1.70 |
| .25 | .22 | 8.95 | 1.70 |
| Peak | | 12.50 | 1.60 |

Users of batteries are warned of the danger of deciding when the battery is sufficiently discharged merely by the

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,470.

We have occasion to make good welded joints in copper wires of all sizes, from the smallest up to $\frac{1}{8}$ in. square. Would a "welding transformer" be suitable for this? If so, what is the arrangement made for adjusting the current to the right value for various sizes of wire?

(Replies must be received not later than first post,
Thursday, Dec. 2nd.)

ANSWERS TO No. 1,468.

I have a D.C. motor rated at 20 h.p., 950 r.p.m., which drives some line shafting for machine tools. It is a 220-volt, 4-pole, shunt machine, with lap-wound armature, and has good commutation. I wish to increase the normal speed to 1,100 r.p.m. for special work during the war, and then to reduce it again to its normal value. What is the most economical way of doing this?

The first award (10s.) is given to "Alpha" for the following reply:—

There are two ways in which the speed of a shunt-wound motor can be readily increased:—

(1) By increasing the air-gap between pole face and armature.

(2) By reducing the field current.

I suggest that in the present case the inquirer should first slack off the bolts holding one of the main poles in the frame, and see whether there are any thin iron shims behind the pole. If so, these should be removed from behind all the poles, and the bolts tightened up again. If this increases the speed of the motor too much, thinner shims of soft sheet iron should be substituted for those taken out. Assuming normal values for the air-gap length and the saturation curve of the motor in question, it is probable that an increase in the length of the air-gap of about $1/32$ " will give somewhere near the required speed. It is impossible to give more definite figures without full particulars of the design of the motor, but if there are shims behind the poles the matter can easily be settled by experiment as described above. The shims taken out can be kept and replaced when the motor speed is required to be reduced to 950 r.p.m. again. The cost of this method would only be the man's time in removing the shims.

If there are no shims behind the poles, it would be possible to increase the gap by grinding back the pole faces or by increasing the bore of the frame, but it would be simpler and cheaper in this case to reduce the field current by connecting a resistance in series with the shunt winding. The makers of the motor would doubtless supply a suitable resistance, all they would require to know being the particulars given on the name-plate (particularly the serial number of the motor) and the amount of speed increase required. If for any reason they cannot be communicated with, an ammeter and a variable resistance should be connected in the shunt-field circuit, the resistance being variable from 0 to, say, 150 ohms, with a current capacity of about 2 amps. The particulars required are the terminal voltage, the shunt-field current taken by the machine with no resistance in circuit, and the shunt-field current, with such value of resistance as

will give the required speed. The test should preferably be taken with the motor warm, i.e., after not less than three hours' run on normal load, and could be carried out in a few minutes by any competent local electrician. From the figures obtained any manufacturer of electrical control gear could make up a suitable resistance unit. No sliding contacts or switch would be necessary, the resistance being merely connected in the field circuit and left there until it is desired to reduce the motor speed to 950 r.p.m., when it can be disconnected. The cost of the resistance would be about 10s. or 15s., to which would be added the man's time in making the necessary test and connecting up the resistance.

As the commutation of the motor is good under present conditions, it is not likely that it would be materially affected by the proposed increase in speed if the machine has commutating poles. If not, it is possible that the operation would be impaired, since the h.p. will presumably be increased at least in proportion to the speed. If it is, the brushes can be given a little more backward lead, and this will probably put matters right. It should not be necessary to adjust the brush position if the motor has commutating poles, but the effect of a small movement forward or backward may be tried if the operation is bad. The best position with commutating poles will be found to be on the neutral point.

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The two methods of increasing the speed of a shunt motor are either to increase the length of the air-gap or to increase the resistance of the shunt circuit, the effect in both cases being to decrease the flux. The increased air-gap is generally obtained by taking out the "liners," or thin sheets of iron that are placed at the back of the pole-cores or of the pole-shoes; but the thickness of these sheets is exceedingly seldom sufficient to give the 16 per cent. speed variation required in the question. Since the commutation at the present speed appears to be good, it will be simpler and more economical to get the whole of the speed variation by decreasing the shunt current. A rough approximation of the value of the extra resistance can be found thus:—

The normal loss in the shunt winding of a 20 h.p. 950 r.p.m. protected type motor is about 500 watts, so that the corresponding shunt current is 2.3 amperes. The magnetisation curve for the machine is not given, but taking values off a typical curve for such a motor, the shunt current must be decreased to about 0.73 of its normal value in order to decrease the flux sufficiently to give 16 per cent. increase of speed. Hence the shunt current at 1,100 r.p.m. is $0.73 \times 2.3 = 1.68$ amps.

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|--------------------------------|------------------------------|---|----------------------|
| 10 | 1·00 | 1·00 | 1·83 |
| 9 | .98 | 1·09 | 1·83 |
| 8 | .95 | 1·19 | 1·83 |
| 7 | .92 | 1·31 | 1·83 |
| 6 | .88 | 1·46 | 1·83 |
| 5 | .83 | 1·67 | 1·83 |
| 4 | .78 | 1·95 | 1·80 |
| 3 | .72 | 2·39 | 1·80 |
| 2 | .63 | 3·17 | 1·78 |
| 1 | .50 | 5·00 | 1·75 |
| .75 | .45 | 5·84 | 1·70 |
| .5 | .37 | 7·45 | 1·70 |
| .25 | .22 | 8·95 | 1·70 |
| Peak | | 12·50 | 1·60 |

Users of batteries are warned of the danger of deciding when the battery is sufficiently discharged merely by the

switchboard voltmeter reading. Instruments are liable to error, and if the voltmeter is reading high, it may happen that the battery is over-discharged on every occasion.

A fact not so well known as it should be is that a cell must not be charged at very low rates, and the attendant should ascertain the minimum charging current from the makers. If charged below this rate the negative plates will be charged, but the positive plates merely sulphated instead of being charged. For this reason "milking" boosters must always be capable of charging at full normal charging current.

On the other hand, charging at too high a rate is also bad; it results in violent gassing long before the charge is completed, and consequently loosening the active material on the positives, which means loss of capacity, and therefore leads to subsequent over-discharge, and the effect will thus be cumulative.

A common error is to assume that if the charge in ampere-hours is 10 per cent. above the discharge, everything is right. But 90 per cent. ampere-hour efficiency may be regarded as the limit, and this means that the charge should at any rate be one-ninth and not merely a tenth more than the previous discharge, even if the very best charging rate is hit upon.

Practically every one of the mistakes mentioned will eventually lead to the cell getting badly sulphated, and when in this condition it exhibits the misleading characteristic of gassing freely long before the charge is completed; this is particularly deceptive, as a high voltage accompanies this phenomenon. With a cell in this condition, if the charge is further continued, the milky appearance will gradually disappear again and the voltage again drop, after which the charging should be continued until the cell becomes normal.

The loss of capacity due to the electrolyte falling below the top of the plates is not always realised. A drop of $\frac{1}{2}$ in. in the case of a plate measuring $7'' \times 7''$ means a reduction of area (and of capacity) by 7 per cent. Low level of the electrolyte also gives rise to corrosion of the positive plates at surface of the liquid, which is assisted by the fact that the specific gravity is lowest at the top, and corrosion proceeds most rapidly in weak electrolyte. "Topping up" water (which should be pure distilled water) should therefore always be added through a funnel and tube so that it reaches the bottom of the cell.

A BOARD OF INDUSTRY : TECHNICAL EDUCATION

Chairman's Address to Yorkshire Local Section

THE inaugural address to the Yorkshire Local Section of the Institution of Electrical Engineers by Mr. H. Hodgson Wright on November 11th was concerned solely with the war and its effect upon the nation from the engineering point of view. After mentioning the extent to which electrical engineering has entered into the present military and naval operations, he anticipates that once hostilities are ended the ability and organisation of Germany will be directed to underselling us in every market of the world. Prohibitive tariffs will, he thinks, to a large extent prevent Germany trading with Belgium, France, Italy, and Russia for many years, but whether we shall allow her to compete freely with us and our allies within the Empire was, he hoped, at least doubtful. To meet the new conditions after the war we must cheapen production by better organisation, improved machinery, designs, and co-operative sales methods. We require a higher and more general standard of specialised technical education for our engineers, in which matter Germany had gone ahead since 1870, and there must be a complete change of the old-fashioned sales methods, which many British manufacturers still continued, of waiting for customers instead of waiting on them. If financial reasons prevent the employment of a staff of highly salaried experts abroad, then co-operative sale methods must be resorted to. At the same time, however perfect we may be individually as salesmen, and however closely we might study foreign markets, there would still be wanting for complete success that organised State assistance which Germany has so lavishly expended upon her foreign industry. Our foreign trade will, said Mr. Wright, never be developed without diplomatic, legislative, and financial assistance. For this purpose a permanent and non-party board of industry was required, presided over by one of our most experienced business men, and advised by a permanent staff of experts.

The address concluded with some detailed references to the education and training both of workmen and young electrical engineers, capable of taking higher commands. So far as the

former are concerned, Mr. Wright advocates the leaving age for primary schools being raised, and finishing schools made compulsory, the last period at the primary school being devoted to apprenticeship training, during which a youth's aptitude or otherwise for engineering would be proved. In 1905 the Leeds Education Authority started as an experiment a day preparatory trades school for boys between 12 and 15 years of age, which has proved a decided success.

As to higher technical education for engineers, this should be sub-divided into "Design," "Works Management," and "Commercial Engineering," and in order to bring out the best that is in those being trained, there must be a closer association between the universities, technical high schools, and the engineering industry. At present much work was done of a purely academic character, which had little practical application. Great advantages would result to the electrical and engineering trades if they submitted to the universities for solution those problems which they have neither the staff nor the time to solve. This in turn could not fail to be of practical value in technical education, and would result in the teaching staff being kept in closer touch with industrial problems.

MICHAEL FARADAY PAPERS

AT the Institution of Electrical Engineers last Thursday, Mr. D. J. Blaizeley, whose wife is Michael Faraday's niece, presented to the Institution some papers of great historical value which had been left at his disposal by his sister-in-law, Miss Jane Barnard, who died in 1911. Miss Barnard lived at her Uncle Faraday's house until his death in 1867. The papers include:—

(1) Letters written to Faraday between 1845 and 1860, from Lord Kelvin, Clark Maxwell, and S. J. B. Morse. (2) Miscellaneous papers. (3) English letters to Faraday from Sir J. Clark, Sir Humphrey and Lady Davy, Charles Dickens, Sir C. Eastlake, J. D. Forbes, Sir W. Henschel, J. Nasmyth, R. Murchison, Lord Roscoe, and many others. (4) Foreign correspondence, including letters from Ampere, De La Rive, Bunsen, Dumas, Gay Lussac, and other well-known men of the period. (5) Three books of lecture notes written by Faraday himself. (6) Miscellaneous autograph letters of Faraday. (7) A book of chemical notes. (8) A book on "Nitrous Oxide," bound by Faraday himself. (9) Pamphlets on Spiritualism, Dry Rot in Timber, and other miscellaneous subjects.

A vote of thanks for this exquisite gift to the Institution was proposed by Dr. S. P. Thompson, who briefly referred to some of the events which were leading influences in the great man's career, particularly his Continental tour at the age of twenty-two as assistant to Sir Humphrey Davy. This journey, said Dr. Thompson, was to Faraday what a university education is to many young men; it changed him from a mere bookbinder's apprentice into an educated man able to think and reason in a scientific manner.

The vote was seconded by Mr. Mordey, who also presented the Institution with a copy of Faraday's "Philosophical Miscellany," which had been given to him earlier by Miss Barnard.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Continuous and Alternating Current Machinery Problems." By W. T. Ryan. 37 pp. $7\frac{1}{2}$ in. by $5\frac{1}{4}$ in. 7 figures. (New York: John Wiley & Sons; London: Chapman & Hall, Ltd.) 2s. 6d. net; by post, 2s. 8d.

"The Testing of Machine Tools." By G. W. Burley. 231 pp. $7\frac{1}{2}$ in. by $4\frac{3}{4}$ in. 110 figures. (London: Scott, Greenwood & Son.) 4s. net; abroad, 4s. 4d.

"Mechanical Technology." By G. F. Charnock. 635 pp. $8\frac{1}{2}$ in. by $5\frac{1}{2}$ in. 503 figures. (London: Constable & Co., Ltd.) 7s. 6d. net; abroad, 8s. 5d.

"Overhead Transmission Lines and Distributing Circuits: Their Design and Construction." By F. Kapper. Translated by P. R. Friedlaender. 300 pp. $10\frac{1}{2}$ in. by $7\frac{1}{2}$ in. 297 figures. (London: Constable & Co., Ltd.) 16s. net; abroad, 17s. 1d.

"Handbook of Technical Instruction for Wireless Telegraphists." By J. C. Hawkhead. Second edition. Revised by H. M. Dowsett. 310 pp. $8\frac{1}{2}$ in. by $5\frac{1}{2}$ in. 242 figures. (London: Wireless Press, Ltd.) 3s. 6d. net; abroad, 4s. 1d.

"Electric Arc Phenomena." By E. Rasch. Translated from the German by K. Tornberg. 194 pp. $8\frac{1}{2}$ in. by $5\frac{1}{2}$ in. 52 figures. (London: Constable and Co., Ltd.) 8s. 6d. net; abroad 9s. 1d.

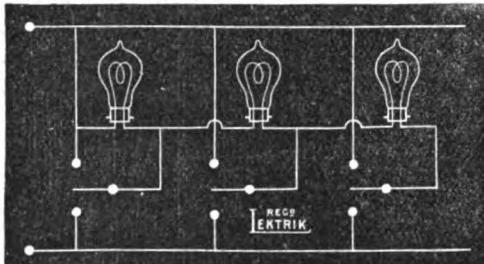
CORRESPONDENCE

ADJUSTABLE RESISTANCES..

To the Editor of ELECTRICAL ENGINEERING.

SIR.—Referring to "J. G. M.'s" reply to Question No. 1,468 in your issue of 11th instant, the variable lamp-resistance illustrated in the adjoining figure may be of interest. The arrangement was devised by Prof. J. D. Cormack, M.I.E.E.

The switches are of our two-way-off ("Duplex") type, and the combinations possible with three lamps and switches are as



follows: 3 series, 2 series, 1, 1 in parallel with 2 series, 2 par, 3 par. Assuming the resistance of each lamp to be 100 ohms, the resistances given by the above-mentioned groupings will be 300, 200, 100, 66·6, 50, and 33·3 ohms respectively.

With four switches and lamps, one can get 4 series, 3 series, 2 series, 1, 2 rows of 2 ser, 1 par with 3 ser, 1 par with 2 ser, 2 par, 2 par with 2 ser, 3 par, 4 par. At 100 ohms per lamp the resistances vary from 400 to 25 ohms.

Trusting this information may be of interest,

Yours faithfully,

A. P. LUNDBERG & SONS.
477, Liverpool Rd., Islington, London, N. Nov. 17th, 1915.

ELECTRIC TRACTION NOTES

Trial trips have been made on the Kingston loop of the newly electrified portions of the London & South-Western Railway Co. The service on this line is to commence on the 28th inst. We published a description of the general equipment of the line and the power-house in our issue for Sept. 23rd, p. 387, and Sept. 30th, p. 395. The first portion between Wimbledon and Waterloo is already working.

In his report upon the trade of Australia for 1914, H.M. Trade Commissioner states that contracts for machinery and plant for the electrification of the suburban railways of Melbourne, amounting to over £2,250,000, had been placed up to June 30th, 1914, and that work was in progress at the power-house at Newport, the car repair shops at Jolimont, and at the various sub-stations. The construction of new cars and alteration of existing cars is being carried out at the Newport workshops. It is proposed to instal the latest system of power and automatic signalling based on the best features of the system now in use on the Metropolitan and District Railways in London. An engineer of the Pennsylvania Railroad Co. has been engaged to superintend the installation of this signalling system. It was anticipated that the first section of the suburban line to be electrified would be completed about the end of this year, but delays have occurred due to the war, and it is uncertain when it will be completed.

The Stirling and Bridge of Allan Tramways Co., which at present runs a horse-car system, propose to convert to petrol-driven cars after the war. The Stirling Council is not convinced that this would be a satisfactory solution, and has intimated to the Company that further consideration of the matter should be postponed until after the war, when the Stirling Council itself will give a decision as to whether it will itself proceed with a scheme of electric traction.

CATALOGUES, PAMPHLETS, &c., RECEIVED

DOMESTIC ELECTRICAL APPARATUS.—A folder from Messrs. Haylock & Haslett (63 Queen Victoria Street, London, E.C.) deals with a series of "hot point" domestic electrical apparatus.

THE MAGNET OF COMMERCE.—With this heading the Great Central Railway Co. has issued a second edition of their booklet dealing with the various coalfields in reach of their railway system. At the same time a good deal of information is given with regard to the Company's new dock at Immingham.

HALF-WATT AND INCANDESCENT LAMP FITTINGS.—Engineering & Arc Lamps, Ltd (Sphere Works, St. Albans, Herts), has prepared a list covering a very complete range of requirements in the matter of half-watt and metal filament lamp fittings, both indoors and out. These fittings are all made at the St. Albans Works, but it is frankly admitted that some of them have been copied from German designs. This does not, however, apply to the details or the mechanical construction, which are claimed to be far more robust. For several types of fittings lanterns are supplied as an alternative to globes, which, owing to their excellent distribution and low cost of replacement, are becoming more and more popular.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Board of Trade Journal, quoting from the Melbourne Argus, states that the Queensland Minister for Works proposes to engage an electrical engineering expert to report as to erecting electric power and lighting stations at Brisbane and Ipswich.

Bo'ness.—The Secretary for Scotland proposes to instal new plant at an estimated cost of between £6,000 and £7,000 provided that it is urgently required to enable the undertaking to meet the demands of firms engaged on Government contracts.

Coventry.—A further expenditure of £30,278 upon new plant has been sanctioned by the Minister of Munitions.

London: Islington.—A loan of £5,455 for mains is recommended by the Finance Committee of the L.C.C., repayable in 25 years.

St. Pancras.—After a controversy lasting over a considerable period arrangements have at last been made between the Borough Council and the L.C.C. for a loan for the purchase of a new 5,000 kw. turbo-alternator, one of the terms being an acceleration of the repayment of certain outstanding loans on old plant.

Woolwich.—The Finance Committee of the L.C.C. recommends sanction to a loan of £4,700 in connection with the linking-up of the Borough Council's electricity undertaking with that of the South Metropolitan Electric Light & Power Co.

Uruguay.—The Canadian Department of Trade and Commerce at Ottawa, says the Board of Trade Journal, reports a demand for electrical machinery here.

Wiring

Cardiff.—Completion of electrical installation at technical college.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Cardiff.—New fire station.

Chesterfield.—Sanction has been given to a loan of £6,000 for extensions at Penmore Hospital.

Eastbourne.—New building for Prudential Assurance Co.

Miscellaneous

Australia.—The Deputy Postmaster-General, Melbourne, requires electric motors, polarised relays, Morse sounders, telephones, and voltmeters. Dec. 7th. He also requires common-battery, wall-pattern telephones. Dec. 14th. Further particulars at 73 Basinghall Street, E.C. These announcements are, of course, only of use to firms who can cable agents.

Japan.—Extensions to the Nagasaki tramways are contemplated. Further particulars at 73 Basinghall Street, E.C.

South Africa.—The South African Railways Administration requires a twelve-months' supply of rubber-insulated cable. Further particulars at 73 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

At the Institution of Electrical Engineers last Thursday the retiring President, Sir John Snell, announced that M. Maurice Leblanc had been elected an honorary member of the Institution. M. Leblanc, in addition to his other scientific work, was one of the pioneers in the development of the modern alternator, and the invention of the Amortisseur or

damping coil was due to him in conjunction with his colleague Hutin.

In consequence of the absence of Capt. Wallis-Jones on active service, Mr. H. W. Couzens, of the firm of Couzens & Brown, has kindly undertaken to execute on behalf of Messrs. Wallis-Jones & Dent, all work now in hand and any future work that may be entrusted to the firm. The postal and telegraphic addresses will remain the same, but the telephone number will now be Victoria 5029.

Mr. B. Sleath, who travels for Messrs. Chamberlain & Hookham and Messrs. Venner & Co. in the west of England and South Wales, and Mr. J. S. Carter, who has recently been travelling in many parts of the world for Messrs. Chamberlain & Hookham, have both joined the Motor Transport Section of the A.S.C.

The whole of the male staff of the Hull Corporation Telephone Exchange marched to the Town Hall on Tuesday, headed by the Manager, Mr. T. Holme, and enlisted under Lord Derby's scheme.

The numerous friends of Mr. A. V. Gifkins, who was so seriously injured a short time ago in the recent Zeppelin raid, will be pleased to hear that he is making excellent progress, and hopes to leave hospital within a fortnight.

The Birmingham Electricity Department require a Telephone Inspector for private telephone system. (See an advertisement on another page.)

An Electrical Engineer is required by the Mexborough Council. (See an advertisement on another page.)

Mr. A. C. Bott, of Anglesea, has been appointed Resident Electrical Engineer by the Holmfirth District Council.

the rateable value of their premises by £1,000. It was pointed out that the Assessment Committee had made the increase in view of certain structural alterations at the works, and also by reason of an increase in the net profits of the undertaking during 1912-13 compared with the profits taken into account at the time of the last quinquennial valuation. Eventually the Court decided to reduce the proposed increase by £400, and held that an increase of £600 was justifiable.

Manchester: *The Barton Electricity Works.*—The Manchester Ratepayers' Association should by now have realised that its opposition to the new power scheme at Barton is futile, and it will be well advised to leave the Electricity Committee and the Corporation to develop the scheme upon the most natural lines. The President of the L.G.B. has replied to a further communication from the Association to the effect that in the opinion of the Board the Corporation has proper grounds for proceeding with the full scheme at the present time, and that the Board is not prepared to intervene in the matter. We gave a description of the station on page 379 of our September 16th issue, and Mr. S. L. Pearce, the Chief Engineer, gave similar information in a lecture to the Manchester Association of Engineers on Saturday last. As showing more than ever the absurdity of the arguments of the Ratepayers' Association, the Minister of Munitions has recently pointed out to the Corporation the enormous importance of adding to the quantity of electric power available in Manchester. The consumption during the past six months has been some 30 per cent. higher than in the corresponding half-year, and the Electricity Committee is doing everything possible to meet the increasing demands.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. G. Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £97 10s. to £98 10s. (last week, £91 10s. to £92 10s.).

Liquidations.—A meeting of the creditors of Kyl-Fyre, Ltd., will be held at 72 Borough High Street, London, S.E., on December 2nd, at 2.30 p.m. Creditors are requested to send statements of claims to the liquidator, Mr. W. H. Cork, 19 Eastcheap, London, E.C.

LOCAL NOTES

Darlington: Electric Power Output.—As has been the case in all other manufacturing centres, the demands upon the electricity undertaking have been making rapid strides, and the Electricity Committee has been left with no alternative but to instal new plant. At the present moment a 3,000 kw. turbo-alternator is on order, and by the aid of this it is hoped to deal with the position for a short time ahead.

Dublin: Position of Electricity Undertaking.—In connection with a proposal to accept a tender for an underfeed stoker for the Pigeon House Fort power station, Mr. John Ryan, a member of the Corporation, said that as an expert would report upon the present position of the electrical undertaking and the means for remedying any defects that might be found, it would be better to postpone this matter. Eventually the report was sent back to the Committee.

Holmfirth: Progress of Electricity Scheme.—The buildings for the electricity works have now been erected, and most of the foundation work for the engines and plant completed. The laying of the cable in the central portion of the district is well in hand, and the contractors will shortly commence erecting the generating plant.

London: Kensington: Electric Supply Co.'s Assessment.—The Brompton & Kensington Electric Supply Co. appealed at the London Quarter Sessions last week against an increase in

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Edison & Swan United Electric Light Co.—At the meeting on Thursday the report and accounts given in our last issue were adopted. Mr. C. J. Ford, the chairman, who presided, said that the net profit for the year was £14,147, against £4,695 in the previous twelve months, but for the reasons pointed out in the report it was not proposed to declare a dividend. The directors thought it the wisest policy to keep the profits in the business rather than to divide them. With regard to lamps, there had been no difficulty whatever in disposing of the whole output, and, indeed, more could have been sold if the manufacturing capacity could have been greater.

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

(To-day) Thurs., Nov. 25th: Sections I. and II. and Signalling Section, shooting.

Fri., Nov. 26th: Sections III. and IV., technical. Sections I. and II., squad, signalling section, and recruits.

Mon., Nov. 29th: Sections I. and II., technical. Sections III. and IV., squad signalling section and recruits.

Tues., Nov. 30th: School of Arms with Architects Corps, 6.00 to 8.00 p.m.

Wed., Dec. 1: Opening of New Headquarters (See Below). 6.25 p.m.

Thurs., Dec. 2nd: Sections III. and IV., shooting.

Fri., Dec. 3rd: Sections III. and IV., technical. Sections I. and II., squad signalling section and recruits.

Technical drill at Headquarters, London Electrical Engineers.

Unless otherwise ordered, all parades at Chester House, Eccleston Place, S.W.

The opening of the new Headquarters takes place on Wed., Dec. 1st, at 6.25 p.m. All members are requested to attend in uniform if possible.

Members are requested to bring as many recruits as possible on this occasion.

Members desirous of applying for commission in the technical branches of the Army should apply immediately to the Commandant or Adjutant, who will give them all the information they require.

Arrangements for the Week.—(To-day) Thursday, Nov. 25th. Institution of Electrical Engineers. "Some Difficulties of Design of High-speed Generators," by Prof. A. B. Field. 8 p.m.

Tuesday, Nov. 30th. Manchester Section, I.E.E. Engineers' Club, Albert Square. "Some Difficulties of Design of High-speed Generators," by Prof. A. B. Field. 7.30 p.m.

Friday, Dec. 3rd. "The Generators." Dinner at Trocadero. 6.15 p.m.



ELECTRICAL ENGINEERING

With which is Incorporated
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SUMMARY

MR. G. SCOTT RAM'S annual report upon electrical accidents in generating stations and factories contains, as usual, a mass of interesting matter (p. 478).

SOME new American rules for flame-proof motors are discussed (p. 480).

A NUMBER of practical points in connection with the use of electricity in mines are discussed in a paper recently read before the National Association of Colliery Managers (p. 480).

THE importance of care in dealing with the bearings of electrical machinery is pointed out (p. 481).

AN electrical method of thawing frozen ground for mining operations has been patented (p. 481).

AMERICAN specifications for miners' electric lamps are reviewed (p. 482).

WE point out the classes of electrical workmen to whom, under Lord Derby's recruiting scheme, total exemption from military service, or some measure of exemption, is to be given (p. 482).

PROF. FIELD'S Paper on turbo-generator design was discussed at the Institution of Electrical Engineers in London on Thursday (p. 482).

AMONG the subjects of specifications published at the Patent Office on Thursday last are thermal meters,

duplex telephony, contactor switches, and single-phase motors. An application has been made for the suspension of an electrochemical patent. The B.T.-H. "dead man's handle" controller patent and a wireless telegraph patent expire this week after a full life of fourteen years (p. 483).

OUR "Questions and Answers" page this week deals with methods of dimming the lights of a small hall (p. 483).

A NUMBER of books are reviewed (p. 484).

THE Illuminating Engineering Society last week discussed the first report of the Home Office Committee on Factories and Workshop Lighting. A further report based on work already done will shortly be published, but the work of the Committee at the moment is at a standstill (p. 485).

AN important correspondence has passed between the Institution of Electrical Engineers and the Local Government Board on the question of the loan periods for electrical machinery (p. 486).

PARTICULARS are given of a number of contracts for telephone apparatus, tramways, and generating plant (p. 486).

DUBLIN wiremen have been granted an increase in wages of $\frac{1}{2}$ d. per hour.—Some interesting figures are given of the output of the Manchester electricity undertaking.—High-tension A.C. supply has been inaugurated at Gravesend (p. 487).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

(To-day) Thurs., Dec. 2nd: Sections III. and IV., shooting.
Fri., Dec. 3rd: Sections III. and IV., technical. Sections I. and II., squad signalling section and recruits.

Sat., Dec. 4th: Parade in uniform at East Putney Station at 2.45 p.m. Train Mansion Ho. Station, 2.22 p.m.

Mon., Dec. 6th: Sections I. and II., technical. Sections III. and IV., squad. Signalling sections and recruits.

Tues., Dec. 7th: School of Arms with Architects Corps, 6.00 to 8.0 p.m.

Thurs., Dec. 9th: Sections I. and II., shooting.

Fri., Dec. 10th: Sections III. and IV., technical. Sections I. and II., squad. Signalling section and recruits.

Sat., Dec. 11th: Instruction class at 2.30 p.m.

Sections for technical parade at Headquarters, London Electrical Engineers, 46 Regency Street, S.W.

Sections for shooting parade at miniature ranges.

Unless otherwise ordered, all parades at Chester House.

(For "Arrangements for the Week" see p. 487.)

ELECTRICAL ACCIDENTS IN POWER STATIONS AND FACTORIES

THE annual report of H.M. Electrical Inspector of Factories, Mr. G. Scott Ram, is, as usual, a thoroughly practical and interesting document. In his introductory remarks he calls attention to the evidence obtained by certain of the divisional inspectors who have assisted him that many contractors put in inferior apparatus and material, on account of cheapness, well knowing that it does not comply with the regulations, but afraid that other contractors are following the same course, and that in competition with them on the basis of plant complying with the regulations the order might be lost. The factory-owner eventually has to suffer, being put to greater expense in putting things in order than if he had paid for the proper material in the first instance. The obvious course for consulting engineers and owners is to specify that the installation shall comply with the Home Office regulations, and if it does not, then the contractor can be compelled to put it right. Having regard to the large amount of standard apparatus which is now made to comply with the regulations, the question of price is not so important as it was some time ago. Local contractors are beginning to realise that bad work is liable to be found out and condemned, and for this reason are improving their standard accordingly. The district inspectors' reports also call attention, among other details, to the inefficiency of earth connections, and high-tension switchboards having passage-ways only 18 inches wide with unprotected conductors along one side. Generally, the inspectors refer to the increased use of electrical energy for power purposes, but the usual estimate of the increase cannot be made, as the necessary returns from sources outside the Department are not available. Four prosecutions for breach of regulations were taken during the year, penalties of £5, £10, and £50 being imposed. The other case failed on legal technical grounds.

The mechanical accidents in electrical generating stations and sub-stations are fewer by 58 than in the previous year, a reduction of 13 per cent. The number of electrical accidents is slightly larger—99 as against 94 in the previous year, with four fatalities as against three. Under the first heading of the table some of the accidents were due to mistakes on the part of the switchman; others were due to matters beyond his control, either to faulty switchgear or to faults on the circuit at some distant point. In all cases the injuries were burns. In one the tank of an oil switch burst, and the attendant was injured by the burning oil. Six of the accidents occurred in the renewing of fuses.

TABLE I.—ACCIDENTS AT ELECTRICAL GENERATING STATIONS AND SUB-STATIONS IN 1914.

(The small figures relate to fatal accidents and are included in the principal figures.)

| Description. | | Stations for Public Supply and Electric Railways and Stat- Traways. | Tons. |
|---------------------------------------|----------------------------|---|-------|
| Non-Electrical :— | | | |
| At engines, pumps, and generators ... | ... 36 | 11 ^a | |
| At boilers and steam plant ... | ... 76 | 1 | |
| At coal-handling plant ... | ... 18 ¹ | 1 | |
| Falls ... | ... 97 ² | 5 | |
| Struck by falling bodies ... | ... 35 ² | 1 | |
| Miscellaneous ... | ... 88 ¹ | 12 | |
| Total ... | ... 350² | 31^a | |

Electrical :—

| | | |
|--|---------------------------|-----------------------|
| At switchboards when engaged in ordinary routine work ... | 19 | 7 |
| Cleaning, repairing, &c., at "live" switchboards or other "live" conductors ... | 29 ¹ | 20 ¹ |
| Cleaning, repairing, or other handling of switchboards supposed to have been made "dead" ... | 2 ¹ | — |
| Adjusting brushes and cleaning commutators and flashing at commutators ... | 2 | 4 |
| Miscellaneous ... | 13 ¹ | 3 |
| Total ... | ... 64² | 34¹ |

One half of the total accidents in electrical stations occurred to men when working on live conductors—mostly on switchboards. Eight occurred on extra high tension systems, and three on high tension systems. Two cases were fatal. One of these occurred in a consumer's sub-station to a man dusting a switch (5,000 volts) in a compartment with a door normally kept locked, but which he had himself opened. He was probably under the impression that the switch was dead, but the controlling switch in another compartment had been left "on." The other case occurred to a man working in an underground sub-station making contact with an inadequately protected tem-

porary cable (2,400 volts). In most of the high tension accidents the injured persons were doing work which was unauthorised and were themselves to blame. In one case an engineer attempted to do some work in a switch cubicle (10,000 volts). The switch was not in use, although live on one side, and it could have been made dead by means of the isolating switches provided for the purpose. This, however, involved the taking down of a heavy iron screen, and rather than take the trouble to do this he took the risk. This accident emphasises the desirability that such doors should be hinged or made to slide on runners so that they may be readily opened. One accident was caused through a short circuit to the framework of the switchboard by the metal end of the insulating pole provided for operating the isolating switches. One accident was due to the misunderstanding of a telephone message. Of the accidents on medium pressure and low pressure systems, 16 were caused by making short circuits with ordinary spanners, screwdrivers, or pliers. One accident was due to short circuit in attempting to remove the tank on a live oil switch. Two other fatal accidents under this heading were reported, but they are not included in the table as they did not occur on premises under the Act. One was in a switch-house on a 10,000-volt system, and the other at a transformer box in the street at 2,400 volts.

The remaining fatality occurred owing to an engineer-in-charge taking hold of live conductors of a high-tension arc lighting switchboard presumably thinking they were dead. A switch controlling the switchboard had apparently, contrary to the usual custom, been left on inadvertently from a previous shift. The victim was no doubt to some extent blameworthy in not ascertaining for himself whether the board was dead.

Under the miscellaneous accidents the fatal case occurred to a man who touched with his head a neutral conductor of a high-tension alternator. Several alternators were running in parallel, the neutral point of one being definitely connected to earth. It had previously been assumed that the neutral points of the other machines would have been very nearly at earth potential. In this case it proved that there was 500 volts pressure to earth. The machines were of different types, and the one in question was of lower voltage than the others and connected through a step-up auto-transformer.

TABLE II.—ELECTRICAL ACCIDENTS IN FACTORIES OTHER THAN ELECTRICAL STATIONS IN 1914.

(The small figures relate to fatal accidents and are included in the principal figures.)

| | |
|---|-----------------------------|
| Arcing of { switches | ... 38 |
| fuses | ... 9 |
| Shock or burns when replacing fuse wires | ... 22 |
| Portable apparatus, connectors, and flexible wires | ... 65 ^a |
| Unprotected conductors, switches, terminals, fuses, &c. | ... 36 ^a |
| Working on live electrical apparatus or conductors: | |
| Skilled persons | ... 42 ¹ |
| Unskilled persons | ... 46 ² |
| Miscellaneous accidents in electrical manufacturing and repair works—mostly in testing operations | ... 55 ¹ |
| Adjusting brushes and cleaning commutators and flashing at commutators | ... 6 |
| Miscellaneous | ... 31 ^{2*} |
| Total ... | ... 350¹⁴ |

The electrical accidents in factories are fewer by 68, or 16 per cent., than in the previous year, the number of fatalities (16) being one less. The accidents in renewing fuses afford examples of the dangers of different types of fuses to which attention has been drawn in former reports. Most of the injuries are burns from short circuit, but some from shock. In some cases short circuits were made by getting the fuse wire or pliers or other tool across the terminals of both poles or between one pole and the metal case. In some instances the fuses had been protected by a switch, but this being at a distance was not used. In other cases, where there was a switch at the fuses it was connected on the wrong side so that the fuse terminals were live whether the switch was "on" or "off." Several occurred with fuses in porcelain carriers having the fuse wire in a groove in the front of the porcelain. In these cases the fuse having blown, the attendant replaced it without having investigated and rectified the fault which caused it to blow in the first instance, with the result that immediately the fuse holder with the new fuse wire was put into contact, the fuse blew again, burning his hand. Others, causing shock, occurred with the "bobbin" or "grip" type carrier having live metal at each end of the porcelain. None of the above arrangements of fuses complies with the Regulations. Fuses not protected on the live side by switches should be of the switch-fuse type so constructed that the hand when grasping the handle cannot touch live metal and is shielded from the arc should a fuse blow when being plugged in.

Of the accidents in the use of portable apparatus, 26 occurred in handling the flexible conductors. One case, having fatal

* One fatality, fall following shock.

results, occurred to a man when working on the wet floor of a dry dock. He was engaged in scraping a ship's bottom and is supposed to have trodden on the flexible cable of a portable lamp cluster, a nail in his boot piercing the insulation of the cable. In many works there is no proper examination of the flexible conductors which remain in use after being badly damaged and worn out. In some cases the metallic armouring of the flexible wires had broken and pierced the insulation. Metallic armouring, especially in the form of a wire helix, is not a desirable form of protection. The earth connection is liable to become disconnected, and through rough usage and constant bending the wire is apt to break and pierce the insulation, and becoming live is very dangerous. Other forms of protection, such as rubber or hard-core braiding, are generally preferable. Twenty of the accidents occurred in connecting the flexible wires to the circuit. In six cases "adapters" were being put into lamp-holders and short circuits occurred. In other cases pin plugs of the old type were used, the wires short-circuiting at the point where they enter the plug. In most of these cases the use of safety-type hand shield plugs would have prevented the accidents. The short circuits which occur in this way are often very heavy, leading to very severe burns, by reason of the circuit being too heavily fused. In one case it was found that the circuit for a hand lamp was fused for 60 amperes. Three cases of shock occurred from unearthing portable drills. Some cases of shock from hand lamps also occurred. One fatal case—also in a dry dock—occurred in the use of a portable "cargo lamp," a cluster of several lamps being mounted in a metal reflector. The whole fitting became live by reason of a terminal screw in one of the lamp-holders being in contact with the barrel of the holder. The man took hold of the reflector of the fitting and was killed. The fitting was not earthed and was not in accordance with the requirements of the Regulations. It is noteworthy that safety-type cargo fittings have been devised and are now on the market.

Under the next heading, "Unprotected Conductors," there were seven fatalities, of which six were due to contact with overhead wires. The wires, although out of reach from the ground, were so placed that workmen in the course of their duties might have at some time to get into close proximity to them. In one case wires covered only with braiding were run out of doors close to a steam valve. A man had to get to the valve and came into contact with the wires (440 volt 3-phase) and was killed. The braiding of wires without any insulating covering is quite useless, and may lead persons erroneously to suppose that they are insulated and safe to touch. The next case was similar, the bare wires although out of reach from the ground were within reach from a pipe bridge on which the man got in the course of his duties. He made contact with the wires and fell to the ground, a distance of 11 ft., and although he died from the results of the fall, he was able to state that he received a shock. The next case occurred at a wharf where pit props were unloaded and stacked. The wires were 22 ft. from the ground, but the props were stacked in some places to within 3 ft. of the wires. The supply was 440 volts, 3-phase. A man on one of the stacks touched the wires and was killed. The next case was also on a 440 volt, 3-phase system. Bare wires were run under the roof of a large engineering shop. Men were at work painting the roof and one of them took hold of the wires and was killed. His mate managed to hold him until assistance came and he was lowered to the ground. Another case was similar in all respects except that the system was 400 volts, 3-phase. Two men tried to get the victim off the wires, but themselves received shocks and he fell to the ground. In the other similar fatality a man was sent to clean out a gutter close to which were live wires at 500 volts, 3-phase. The seventh fatal case occurred in an engineering works to a man touching the live parts of a 240-volt, 3-phase switch which had no cover and which he had to use. It was a throw-over type of switch having double blades at right angles on each pole so arranged that in grasping the handle the hand would be liable to touch the projecting blades of the outgoing side. Of the non-fatal accidents nine were in connection with electric cranes. Five were by men touching the bare trolley wires when getting in or out of the cage. Four were due to unprotected conductors in the cage.

Under the next heading, "Skilled persons working on live conductors," the fatality occurred on a 440-volt, 3-phase system. Alterations had to be made to a motor circuit, and the electrician cut into a live wire with a pair of pliers. It was found that the fuses protecting the circuit had been removed from two of the wires, but not from the third. The accidents under this heading might for the most part have been avoided if the work had been done at night when the works were shut down. Several occurred at switchboards when tightening nuts with ordinary uninsulated spanners.

The corresponding accidents to unskilled persons are less excusable, as the men should not have been allowed to attempt the work. In many works, sometimes even in large works using a very considerable amount of electric power, no technically qualified person is employed, and unskilled workmen are consequently permitted to attempt repairs or alterations at great risk to themselves. The two fatalities occurred on travelling cranes. In one case the driver was oiling the gear on the crab crane. In the other a fitter was repairing the crane and came into contact with the

live trolley wires. In both cases the system was 440 volts, 3-phase. Of the non-fatal accidents the victims were described as labourers (13), fitters (9), bricksetters, oilers, &c. They were mostly attempting to do some work on the electrical apparatus for which they were quite incompetent.

That the testing of electrical apparatus in electrical manufacturing works is largely carried on by apprentices and pupils is again indicated by the ages of the persons meeting with accidents. The fatal accident occurred, however, to an experienced electrician, who touched wires at 2,000 volts apparently under the impression that they were dead. Artificial respiration was carried on for two hours without success. In another case a man touched some testing leads at 12,000 volts pressure. He was rendered unconscious, but was brought round by artificial respiration. In the other cases the injuries were mostly burns from short circuits. The testing departments of electrical manufacturing works are often carried on in a very unsatisfactory manner. There is unnecessary exposure of live conductors where they are liable to be accidentally touched. Any old connecting cables with damaged insulation are considered good enough. Even in high pressure testing unnecessary risks are run. In one large armature winding shop it was customary to test the armatures by applying 2,000 volts between the commutator and the spindle. A twin flexible cable was connected to a transformer in a cabin, the other end being moved about to whatever part of the shop a test was required, perhaps twenty or thirty yards from the cabin. The cable terminated in bare ends projecting from short vulcanite sleeves. There was only one tester, who could, of course, not be at both ends of the cable at the same time. An accident occurred at an armature under test, the armature winder, who was applying the ends of the test leads, getting a shock. The tester was walking back to the test cabin where at the moment there was no one to switch off the current. In this shop also there was no one qualified or instructed in first aid methods, someone having to be fetched from another department of the works.

Amongst the miscellaneous accidents there were three fatalities. One occurred to an electrician in a large iron works in switching on a lighting circuit transformer, arranged across one phase of a 460 volt 3-phase system, at a totally enclosed ironclad switch, the case of which was not earthed. The switch was of a well-known type, having fuses in the same box so arranged that when the switch is in the "off" position the fuses are withdrawn from the contacts, and by opening the cover they can be renewed in safety. The apparatus was intended by the makers for use with cartridge type fuses. As so often happens, however, the cartridge fuses had been replaced by wires. The electrician in question had the duty of switching on the lights at dusk, and in order to prevent other employees switching on before the proper time, it appears that he had disconnected one end of one of the fuse wires and had closed the cover of the switch. Later on, when he went to turn on the lights, he had evidently forgotten that the fuse was disconnected, and the effect of putting the switch to the "on" position was to make the fuse wire live and bring it into contact with the metal case, giving him at the same time a shock which proved fatal. The accident would, no doubt, have occurred to any other employee attempting to turn on the lights. At the inquest it was urged that the apparatus was advertised as being "fool-proof." It is evident that this description requires some qualification. In the second fatal case the man received a shock from a 200 volt 2-phase motor, the frame of which was live and not earthed. He was about to start up the motor and had turned on the main switch, but not the starting switch. He was engaged in shifting the belt on to a loose pulley and his hand was trapped between the pulley and the belt. A man who went to his rescue also received a shock. The third fatality occurred to a boy, who climbed up on to a roof where he had no business, and took hold of two wires of a 440 volt 3-phase system. Amongst the non-fatal accidents two were due to stay wires of poles becoming live. In one case an electrical engineer took hold of a stay wire and was unable to let go. His two assistants, who were fortunately at hand, succeeded in pulling him off by his clothes. The system was 440 volts 3-phase, and the leakage was due to the failure of an insulator.

(To be concluded.)

Institution of Electrical Engineers.—The following is the result of the ballot for the election of new members, and transfers from one class to another, at the meeting on Thursday.
Members: H. E. Brockwell, F. A. Nield. *Associate Members:* E. Graves, C. E. Wright. *Graduates:* J. M. Bhattacharjee, A. M. Bower, J. W. Collett, J. S. Jenkins, A. Lauder, C. H. Sparks, G. M. Templer. *Students:* T. B. Berry, J. E. Brigg, W. B. Coulthard, E. E. de Boissière, A. C. Ferreira, E. Forster, H. J. Hindom, R. M. Holland-Pryor, A. Howard, I. Levy, R. E. M. Linay, W. Moore, B. M. Murray, J. E. Price, A. Raistrick, J. W. Ryde, D. H. Simmonds, F. Smith, E. Walker, H. B. Warden.

Candidates transferred:—*Associate Member to Member:* L. G. Caunter. *Graduate to Associate Member:* S. Burns. *Student to Associate Member:* D. B. Da Cunha, H. J. Eley, W. A. Hatch, A. F. Sykes. *Student to Graduate:* A. L. Bedford, L. M. Jockel.

ELECTRICAL ENGINEERING IN THE MINING AND METAL INDUSTRIES

Published on the First Thursday of each month

AMERICAN RULES FOR FLAME-PROOF MOTORS AND ACCESSORIES

AN excellent set of rules has been drawn up by the American Bureau of Mines, specifying the precautions to be taken in the manufacture of explosion-proof motors and accessories.

The design and construction must be especially durable, and the protective devices used must not only be capable of preventing the passage of flames from the interior to the exterior of the motor casing, but must also possess sufficient mechanical strength to insure against the accidental destruction of their protective qualities.

Starting rheostats and other necessary equipment that may cause an ignition of gas must be protected as adequately as the motor itself. The casings of starting rheostats must be explosion-proof. The resistances and contacts of the starting rheostats used with portable motors of not more than 50-h.p. capacity should be enclosed in the same box, unless enclosed in separate boxes connected by approved piping through which all leads are carried. All leads entering the explosion-proof casing of a starting rheostat should pass through the casing in the form of properly-protected insulated studs of approved design. The use of rubber bushings will not be approved, because the bushing may become displaced and thus destroy the explosion-proof quality of the casing. The casing of the starting rheostat should be mounted on the motor casing, if possible, and the intercommunicating openings for the passage of leads should be made large in order to prevent the rise of pressure that always attends the propagation of an explosion through a small hole from one compartment to another. If it is not possible to mount the starting rheostat on the motor frame, all leads connecting the starter with the motor should be carried in rigid metallic conduit.

Unless means for opening the circuit both automatically and by hand are provided in a separate explosion-proof casing, they should be incorporated in the design of the starting rheostat. If the starting rheostat is mounted on the frame of the motor, provision should be made for entirely disconnecting the electric circuit from the starting rheostat.

All joints in the casing of a motor or of any of its accessories must be metal-to-metal joints with faces not less than 1-in. wide, and if the pressure developed in the motor casing by explosions can exceed 50 lb. per sq. in., the faces must be not less than 1½ in. wide. All bolt-holes must be bottomed or so arranged that the accidental omission of a bolt will not give an opening through the casing. All openings in the motor casing other than those provided with protective devices by the manufacturers must be tightly closed. It is desirable that such openings be as few as possible. There should be no exposed terminals or contacts outside the motor casing. If there are glass-covered openings in the casing of a motor, the glass should be of ample thickness and should be protected by strong metal covers that close automatically unless held open by hand. Armature bearings must be so designed that under no circumstances can an explosion be propagated from the interior of the motor casing around the armature shaft or through the oil wells.

If there are any sliding or rubbing contacts in connection with the cable reel, such contacts should be provided with explosion-proof protection, and any plug connections should be constructed so that they will be explosion-proof. At the point where trailing cables enter the frames of portable motors, the cable should be protected with suitable armour or flexible metallic conduit, securely fastened to the frame of the motor, and of a sufficient flexibility to prevent short bends from occurring in the cable. The cable should not be fastened to this armour, but there should be provided inside the frame of the motor an insulated clamp of approved design for securely fastening the cable and taking all mechanical strains that may be put upon it.

In testing a motor to establish its permissibility, the motor casing will be filled and surrounded with the most explosive mixture of Pittsburgh natural gas and air. The motor will then be operated at its rated speed and the mixture within the casing ignited by a spark plug, by a spark from the motor

brushes, or by any other means that simulates the conditions of actual practice. Similar tests will also be made with greater and with less amounts of gas in the explosive mixture and with coal-dust sifted into the motor casing or into the protective devices.

Tests will also be made to determine the point of ignition that gives the greatest pressure, and tests will be made by igniting from such a point. In order for a motor to pass these tests, it shall in none of them cause an ignition of the gas surrounding the motor or discharge flames from any part of the motor casing. Neither shall the motor develop dangerous after-burning or excessive pressure in the case of the motor or its starting rheostat.

PRACTICAL POINTS FOR COLLIERY MANAGERS

AT a recent meeting of the Lancashire Branch of the National Association of Colliery Managers a Paper was read by Mr. Ralph R. Smith on "Practical Points in Connection with the Use of Electricity in Mines."

The subject of switchgear was first treated. It was stated that preference should be given to switches of the oil-immersed type, and, in general, selection of switchgear should not be governed by price, but requirements should be stated to manufacturers of repute, when satisfaction would be assured. The chief points to be considered are strength, simplicity, liberality in design of copper parts and of insulation, and absence of all possibility of open sparking or risk of shock. Switchgear should be of the floor-mounting type in preference to wall-mounting, as in the latter case the walls are apt to "squeeze," and break the switch-frames.

Turning to a consideration of motors, the author said these should be chosen with an ample margin for overload, and with due regard to the class of work to be done. For instance, a squirrel-cage motor, although the hardest and least susceptible to sparking, will not start up under a heavy load, such as a haulage gear. Slip-ring and continuous-current motors, however, will start up under very heavy loads. It is a good plan where motors up to, say, 80 or 40 h.p. are working in a damp or dusty atmosphere to have them totally enclosed, as that preserves the insulation of the windings. With larger motors than this, special arrangements have to be made, because a totally-enclosed motor will only develop about half its horse-power, the output being limited by the temperature rise.

Attention was called to the importance of the size of the air-gap. Alternating-current induction motors have a very small clearance between the rotor and stator, and the danger, of course, is that the bearings will wear and allow the rotor to foul the stator, thereby causing a burn-out of the windings. For mining work, it is advisable to choose a rotor with a large air-gap, and sacrifice to some extent the efficiency. Some makers have adopted an adjustable bearing which adds to the reliability of the motor and the life of the bearings.

With regard to cables, the most suitable type for mining work was the bitumen-insulated, as water has little or no effect on it.

The author next turned attention to the subject of power distribution. Three-phase current, he said, has advantages over direct current owing to its ease of transformation to different voltages, its consequent suitability for long-distance transmission at high voltage with a minimum of loss due to resistance, and the saving of copper that can be effected. A.C. motors are less liable to breakdown or sparking, and commutator troubles are eliminated. He recommended the use of high voltage for motors of 50 h.p. and upwards, in order to do away with transformer losses.

On the subject of earthing, the best way to accomplish this, said Mr. Smith, is to secure a suitable place on the surface to bury a main earth-plate. The ground should be of a damp, clayey nature. Two earth-plates, about 4 ft. square, connected together at about 20 to 30 yards apart, are much more effective than a single plate twice the size. All electrical apparatus working with a voltage exceeding that of low pressure should be earthed. A very important point is not to rely upon the cast iron of the switch cases and joint-boxes to

form part of the circuit, as cast iron has a very high resistance. In all such cases the switches, &c., should be bonded. In addition to this, it is advisable to have two distinct earth connections to all apparatus, so that if one works loose there is always a safeguard. A good way to ensure against loose connections is to use lockwashers on all joints; this also applies to the live conductors.

The best way to test an earth circuit was stated to be as follows:—Disconnect both plates from each other, and with a low-reading ammeter and voltmeter, and about three or four dry cells, see how much current can be sent from one plate to the other through the earth, with a certain voltage. The Board of Trade standard for this is that a pressure of four volts shall suffice to pass a current of 2 amperes from one plate to another, through the earth. In this case the resistance works out to 2 ohms. Under these conditions one can feel quite content about the main earth-plates.

The author then read, in a form suitable for issuing with instructions to electricians and others, a list of faults likely to cause shocks or breakdowns. The more important of these are as follows:—

Cables: Slinging unarmoured cables without regulation slings, insufficient number of slings, passing between roof and beams, or between wall and props, abrasion of covering, damp situation, inefficient bonding of armouring, joints without boxes.

Motors: Excessive heating, excessive vibration, oil leaking from bearings, faulty connections, sparking, wearing of bearings, accumulation of oil and dirt on the windings, oil rings not rotating.

Transformers: Excessive heating, insufficient oil.

Switches & Starters: Dirty or insufficient oil, loose nuts, bad contacts, defective springs, water on or near switches, oil creeping along cables.

Earth Wires: Broken or damaged, hanging loose, connections badly made, loose or dirty, signs of corrosion, twisted joints.

Lighting: Wires too tightly stretched or too slack, joints not insulated, lamps and wires likely to catch persons passing, &c., wet places, defective fittings.

Accessories: Defective rubber gloves (rubber gloves much safer when faced with leather), wet or dirty sand.

Mr. Smith concluded his Paper with an explanation of his arrangement of signalling underground to prevent open sparking by putting the wires together. One wire is run on one side of the road and one on the other, insulated or bare as desired, and in one of the lines, usually the manhole side, about every 75 yards a small pull switch is inserted which is flame- and explosion-proof. It then requires only a slight pull at any portion of the wire to make contact from inside the switch to the wire on the other side of the road. The wire with the switches inserted is supported on the props by being passed through porcelain tablin insulators. The system is very simple and cheap, and has so far given remarkably good results.

BEARINGS OF ELECTRICAL MACHINERY

THE electrical engineer has not only to keep bearings in good running order, but on occasions has to decide which type of bearing is most suitable for certain conditions of load. In a recent paper before the West of Scotland Branch of the Association of Mining Electrical Engineers, Mr. Andrew Gibson dealt with the whole subject of bearings of electrical machinery in a comprehensive manner. At first sight it would appear, he said, that problems regarding bearings are easy of solution, but that this is not so had been proved by mysterious cases of heating and seizing of a perfectly sound bearing which, perhaps, was one of three identically the same on the same shaft. The remarkable effect of a thin film of oil in an ordinary bearing had been well shown in Beauchamp Tower's famous experiments, which showed that a steel shaft in a gunmetal bearing lubricated with sperm oil seized at a pressure of about 600 lbs. per square inch under steady running, whereas when dry the same materials seized at about 10 lbs. per sq. in.

The oily or greasy film between the shaft and the bearing seems to act in the same way that a great number of metallic balls would, by supporting the load and keeping the surfaces apart. The breakdown of this film allows the surfaces to come together, and the consequent metallic friction, producing heat, to all intents and purposes welds the two surfaces together. The load at which this occurs depends chiefly upon the viscosity of the oil, in which temperature plays an important part. The thicker and less free-flowing an oil is the greater unit pressure it will stand in a bearing without squeezing out. A very light spindle oil, for instance, will stand, say, a pressure of about 50 lbs. per sq. in., whereas a cylinder oil of good body will stand a pressure of over 2,000 lbs. per sq. in. on the same bearing. Therefore, the unit pressure which any bearing will stand depends chiefly upon the lubricating film, which in turn is influenced by the arrangement of the bearing surfaces.

The allowance commonly made for the running fit of the

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bearing and shaft is about $0.0005 (D+1)$, where D is the nominal diameter of the shaft in inches. Some manufacturers of fast-running machinery make the diameter of the bearing exceed that of the shaft by nearly twice that amount. This clearance allows the shaft to take up an eccentric position in the bearing, leaving a space on the side from which the load is applied. It is at this point that the lubricant should be introduced, so as to spread itself upon the shaft, adhere to it, and travel round upon the surface, being forced between the bearing surfaces at the pressure necessary to support the load.

The cutting of oil grooves in bearings is a matter requiring extreme care and attention, as a groove placed where the oil is under pressure would act merely as a collector for the oil, and provide it with a path of escape before it had accomplished its purpose. As much thought and care should be given to the grooves as to the rest of the bearing, and it should be kept in mind that their function is to distribute the oil between the bearing and shaft where the load is not supported.

With regard to ball bearings, the author pointed out that these fulfil the condition of reducing friction to the lowest possible amount, and better, perhaps, than any other type, but there are certain disadvantages with them. The principal one seems to be delay in the working of the machine if repairs have to be made to the ball bearing. Nevertheless, there is a growing demand for them for all classes of machinery because of their free-running properties and the small amount of attention required to maintain them. An important point is to have self-aligning ball bearings, because a bearing which cannot adjust itself to suit the shaft requires extreme accuracy in fitting up, and the least inaccuracy in alignment and housings results in wedged and broken balls and abnormal wear.

ELECTRICAL MINING PATENTS FOR NOVEMBER

THE only electrical patent of mining interest published during last month is for an electrical method of thawing frozen ground for mining operations in cold climates, which is described by J. R. Quain in Specification No. 20,721 of 1914. A spiked tool containing a heating element, which is resiliently mounted to be unaffected by shocks, is driven into the ground.

ELECTRIC MINING LAMPS IN AMERICA

A N interesting Paper was read before the West Virginia Coal Mining Institute by Mr. H. H. Clark, of the United States Bureau of Mines, and we give the following information from an abstract recently published in the *Colliery Guardian*. It appears that the Bureau of Mines has been encouraging the development and adoption of portable electric mining lamps for some years as a measure of safety. They have issued a set of specifications, which include a fair amount of detail. The lamps are to contain a device which will extinguish the lamp as soon as the bulb is broken. The minimum amount of light recommended is the amount given by a good safety lamp, but almost every electric lamp submitted to the Bureau gave more light than this. The time of burning was set at 12 hours, in order to leave a margin over usual hours of use.

Considerable emphasis is placed upon the distribution of light. A narrow ray of light giving contrasting areas of light and shade is not approved of, and the Bureau asks that the angle of the ray should be so large that the light is thrown practically everywhere that a man's eye could turn. To secure a longer life and more uniform performance than hitherto in the actual lamps, the Bureau has prepared a specification to which some lamp manufacturers already adhere. Great stress is placed upon the importance of mechanical details in the construction of the complete lamp. One of the parts that has given considerable trouble is the flexible wire connecting the headpiece and lamp on the miner's cap to the battery. It is this part which has given out most frequently in the cases investigated by the Bureau. In conclusion, emphasis is laid upon the necessity of selecting a capable man to take charge of the lamp-house, and mention is made of the fact that electric lamps require less lamp-house space per lamp than oil lamps, and this should be borne in mind when adopting them.

THE ELECTRICAL INDUSTRY AND RECRUITING

A LTHOUGH the list of trades which are vitally important at the present time for war work or for other essential requirements, and the list of reserved trades essential for the maintenance of some other branches of trade and industry, are not yet complete, it is possible from the lists which have already been published to gather some idea of the extent to which the electrical industry will be exempt from recruiting under Lord Derby's scheme. To begin with, the whole of the employees in public utility services, which include electric supply and tramways, are indicated as reserved occupations, but this list is subject to reconsideration according to circumstances. This action on the part of the Reserved Occupations Committee, which, it is said, is sitting daily, will, at any rate, remove to some extent the anxiety which many central station engineers have been put to in order to keep their staffs either from enlisting or going elsewhere by the attraction of higher wages. It has been urged for a long time that an official pronouncement of this character would imbue the men with a full sense of their responsibility, and cause them to remain in their positions. Incidentally, it may be here pointed out that the Local Government Board is understood to be considering the whole position of placing employees at electricity works on the same footing as employees working in Government factories, thus giving an electricity committee the right to object before a Munitions Tribunal to men leaving their service for enlistment or other purposes. In the same reserved class are included electricians engaged upon the maintenance and repair of tools and machinery of any sort. Among the trades in the list of those vitally important at the present time for war or other essential requirements are included wiremen and electricians engaged in shipbuilding or upon ships, as well as armature-winders and electrical instrument makers. Similarly, all classes of workers below ground in mines come within the same category, and among the workers above ground are included electricians.

Fire Damp Detector.—A pamphlet has been issued by The General Electric Co., Ltd. (67 Queen Victoria Street, London, E.C.), describing the "Migas" detector. This is an instrument for determining rapidly and accurately the percentage of fire damp (marsh gas) in the air at any point. It is stated that a reading can be taken in about 15 secs., and its accuracy depended upon to within 0·03 per cent. The detector is made in two forms, the "standard," which indicates from 0 to 3 per cent. of inflammable gas, and the "naked light" form, which is specially designed for high accuracy between 0 and 1 per cent. The latter is intended for use in collieries in which naked lights are permitted. The instrument is strong and portable, weighing about 13 lb.

TURBO-GENERATOR DESIGN

T HE Paper on the design of high-speed turbo-generators, summarised in our last issue, was read by Prof. A. B. Field at the Institution of Electrical Engineers in London last Thursday. The meeting was held in the library of the Institution, and Mr. C. H. Wordingham, who presided, said they were gathered in the library as "in the case of certain events it might be safer" than the lecture hall.

The discussion on the Paper was opened by Professor S. P. Thompson, who referred to the core discs $2\frac{1}{2}$ in. thick without any central core, and asked what was the basis for the statement that the plate construction gave a rotor as rigid as a solid one. He also regretted the American frequency of 60 cycles per sec., as against the standard frequency of 50, which was now being almost universally adopted. Dr. Thompson also made use of the opportunity to call members' attention to the interesting old Holmes machine in the basement of the Institution (see ELECTRICAL ENGINEERING of August 19th, p. 347).

Mr. F. H. Clough (B.T.-H. Co.) approved of the method of rating the machine given in the Paper, and said that under the old rating standards, with their overload allowances, and making provision for the power factor, he assumed this machine would be about 14,000 kw. With regard to the rotor construction, he considered the use of through shafts quite feasible on machines of this size, and their use would permit of ventilation holes through the rotor and hence a smaller diameter of machine. Then he thought the machine would have been cheaper had it been designed with less flux and higher current density. He did not agree with the making of rotors without fans in order to shorten them and run them below critical speed. It was quite feasible to run above critical speed. With regard to the rotor winding, pressure on the slot portion of the winding was not essential, as this pressure could not be placed on the end bends. The elaborate rotor coil bracing he thought unnecessary, as, owing to the large angular momentum of the coils when in motion, there was little risk of their being moved by the retarding forces on short circuit.

Mr. H. Burge (Crompton & Co.), referring to the plate construction of the rotor, questioned whether the plates would not be liable to rotate with respect to one another on short circuit. He approved of the magnetic wedge described, and said that even on small machines the use of an iron wedge might reduce the iron losses by 50 per cent. He advocated the use of stranded conductors for avoiding eddy losses.

Dr. S. P. Smith asked why it was considered advantageous to run rotors below their first critical speed; if the running speeds of these machines were to be thus limited, we should very soon come to the limits of output of turbo-generators. With regard to the built-up rotor, he thought a solid rotor with bolts through, as described, might be as strong or better in some ways.

Mr. W. M. Mordey said the feature of ability to stand short circuits on test should be insisted upon in specifications for turbo-generators. Short circuits should be required on full load (with full steam pressure behind), as well as on no load.

Mr. R. Livingstone (Dick, Kerr & Co.) did not think that the time had yet come in this country for the use of such large machines as the one described, and attention might usefully be devoted to smaller units. With regard to the use of magnetic material for end bells, he thought the difficulties caused by leakage were generally over-estimated. He thought that in power stations of the future more elaborate provision would be made for the provision of special ventilating plant, including the necessary apparatus for washing the air.

A communication was read from Professor Miles Walker, in which he said that he considered solid forged rotors would be suitable for machines up to a size of 50 inches and 1,500 r.p.m. He thought forgings of sufficient strength and reliability could be obtained. With reference to the edge-wound rotor coils described in the Paper, he considered they were suitable for machines up to this size, but for larger machines better construction would have to be adopted, and lantern slides were exhibited showing a type of construction having concentric space end connections for the rotor winding.

Professor Field, in replying to the discussion, said that it had been his experience in the United States that solid forgings of suitable strength could not be obtained for rotors. In replying to Dr. Thompson, he said that stiffness of the rotor was proved by its high critical speed. With regard to the rating of machines, he considered the new standard ratings very much better, as machines are more likely in the future to be run continuously at or near full load. Regarding the feasibility of using through shafts instead of rotors, he did not deny this at all, but did not consider there was any advantage in doing so. He considered that the bracing of rotor windings, as he had described, was most essential, as the retarding forces on the coils were enormously large. He had seen large square shafts twisted by these forces, and inspection of some old machines whose windings had not been braced led him to believe that these would cause trouble in the future.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Nov. 25th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

21,792/14. **Thermal Meters.** P. M. LINCOLN. A wattmeter comprising two derived circuits traversed by two superposed currents, one of which is proportional to the voltage and the other to the amperage of the circuit in which the energy is to be measured. These currents are additive in one of the circuits and opposed in the other. Means are associated with each circuit for receiving and temporarily storing during a definite time the energy effect therein, and means are provided for indicating the difference between the average stored during the period in question. (One figure.)

22,554/14. **Duplex Telephony.** BRITISH INSULATED & HELSBY CABLES, LTD., W. P. FULLER, and H. H. HARRISON. A system of duplex telephony over long lines, in which the physical and phantom circuits are simultaneously loaded by a single inductance coil of special construction, without the production of a stray field. (Eight figures.)

23,544/14. **Contactors.** B.T.-H. Co. (G.E. Co., U.S.A.). An electromagnetic lock-out switch having an armature acted upon by two opposing magnetic forces, and an auxiliary armature adapted when the switch is excited to place a spring under stress, the force of which causes the switch to close when the exciting current falls to a value at which the spring force exceeds the difference between the opposing main forces. (Eleven figures.)

4,079/15. **Single-phase Motors.** J. L. ROUTIN. The combination of several single-phase motors with slip-rings connected to suitable points on their armature windings, arranged in parallel. The stator of each has two coils, one to neutralise the self-induction of the armature and the other, not in series with the rotor winding, fed at constant pressure with a suitable phase difference from the supply voltage. (One figure.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: STEVENSON and WILLIAMS [Span wire arc lamp suspension] 21,706/14; UCAR [Establishing an arc between electrodes not in contact] 2,349/15.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: W. T. HENLEY'S TELEGRAPH WORKS CO. and SAVAGE [Gripping cables] 2,289/15.

Dynamos, Motors and Transformers: B.T.-H. Co. (G.E. Co., U.S.A.) [D.C. dynamos] 22,131/14; KUYSER [Dynamo] 22,383/14; COLLET [Generating set] 6,098/15.

Electrometallurgy and Electrochemistry: NELSON [Electrolytic cells] 9,411/15.

Heating and Cooking: HOLDSWORTH [Electrically heated boilers] 1,892/15.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no

Incandescent Lamps: GROTE and REYNOLDS [Tungsten filaments] 22,057/14; KUYSER [Dynamos] 22,383/14.

Storage Batteries: NAYLOR [Accumulators] 3,326/15.

Switchgear, Fuses and Fittings: IGRANIC ELECTRIC CO., LTD. (Cutler Hammer Mnf. Co., U.S.A.) [Electromagnetic switches] 3,837/15, [Pressure actuated switches] 4,561/15, and [Controllers] 5,001/15.

Telephony and Telegraphy: MUIRHEAD & CO. and SQUIER [Telegraphy] 22,265/14; KERSTING [Intercommunication telephones] 22,549/14.

Miscellaneous: MAITRE and MARTIN [Contact breaker for electromagnetic vibrating members] 3,583/14; BEIN [Watertight bells] 21,536/14; GOLDSTONE [Dry battery torches] 2,036/15; KILNER [Bells] 9,441/15.

The following Amended Specification is now available:—
Telegraphy: V. BOUCHARDIN [Polyphase wireless sender] 18,009/14.

Amendment made

19,484/14. **Radiators.** P. GOOD and A. E. WOODHOUSE. This specification for a former for heating elements for electric fires has been amended by references to Patents Nos. 21,557/10 and 17,945/14.

Application for Suspension

605/09. **Electrochemistry.** SIEMENS BROS. & CO., LTD. (Siemens & Halske.) An application for the suspension of this patent of enemy origin has been made by the Refractory Zinc Ore Treatment Co., and will be heard on December 10th. The specification describes the electrolysis of aqueous saline solutions by means of manganese dioxide electrodes.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

24,807/01. **Traction Controllers.** B.T.-H. CO. (F. Case, U.S.A.). Controllers with a form of the "dead man's handle" feature, which breaks the circuit when the driver relaxes his grip of the handle.

24,825/01. **Wireless Telegraphy.** J. A. FLEMING and MARCONI'S WIRELESS TELEGRAPH CO., LTD. A wireless sending system, in which two or more subsidiary condensers are placed in the secondary circuit of the transformer, besides the active condenser in circuit with the primary of the oscillation transformer.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps: F. M. LEWIS [Arc lamp carbons] 18,469/09.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: A. M. BOURKE [Insulators] 18,690/09.

Electrochemistry and Electrometallurgy: H. SCHMIDT [Electroplating] 18,043/07.

Ignition: C. A. VANDERVELL [Magneto switches] 534/09.

Storage Batteries: A. M. TAYLOR [Battery boosters] 18,636/09.

Switchgear, Fuses and Fittings: G. WILKINSON [Automatic transformer switches] 17,786/06; F. SCHOFIELD, E. EDWARDS, and C. TICKELL [Tramway signals] 4,600/09.

Traction: E. G. PINK [Overhead conductors] 18,499/09.

award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,471.

I have about twelve motors, varying in size from 30 to 200 h.p., running on a 25-cycle, 3,000-volt system, all driving haulage gears. I propose to double this number of motors, at least, and to add motors up to about 500 h.p. for driving heavy haulages, air compressors, &c. Would it be efficient and worth the extra capital outlay for more flexible running and standardisation, &c., to change my system, to, say, 40 or 50 frequency? In order to do this I have to add considerably to my power-

station units. In this case I should have to scrap the above 25-cycle system or instal some method for running 25-cycle motors from a new system of 40 or 60 cycles, assuming that my existing 25-cycle generators require absolutely renewing. What is the best arrangement for running 25-cycle motors from a 40-cycle system? And what are the principal factors to take into consideration for embarking upon such a scheme.

"REPRESENTATIVE."

(Replies must be received not later than first post, Thursday, Dec. 8th.)

ANSWERS TO No. 1,469

The lighting of a small hall is effected by 54 metal-filament lamps connected to a 100-volt A.C. supply of 50 periods per second frequency. What is the best method of using choking coils for dimming purposes, on two groups of 26 100-watt lamps and 20 32-watt? The remaining eight lamps are 40-watt, and require no dimming. How does the candle-power of a lamp vary with the applied voltage?

The first award (10s.) has been made to "Arc" for the following reply:—

Since the lamps in any one of the two groups are to be dimmed simultaneously, the simplest arrangement is to connect two choking coils, one in series with each group, the chokers being each fitted with tappings and a switch, so that the number of turns in circuit can be varied. Such an arrangement is described and illustrated in Maycock's "Alternating-Current Work," pages 220-1.

As regards the variation of the candle-power of metal-filament lamps with the voltage, this is given approximately by the expression $C.P. = kE^2$, where k is a constant. From this expression the first two columns in the following table have been calculated, the first column being the percentage of the normal candle-power of the lamp, and the second being the corresponding voltage across the lamp.

| Percentage candle-power. | Volts across lamps. | 26 100-watt lamps. | | 20 32-watt lamps. | |
|-----------------------------|------------------------|--------------------|-------------|-------------------|-------------|
| | | Current. | Inductance. | Current. | Inductance. |
| 100 | 100 | 26 | 0 | 6.4 | 0 |
| 90 | 97.5 | 25.5 | .0027 | 6.27 | .011 |
| 80 | 94.6 | 24.9 | .0040 | 6.12 | .017 |
| 70 | 91.4 | 24.2 | .0053 | 5.96 | .022 |
| 60 | 87.9 | 23.5 | .0064 | 5.78 | .026 |
| 50 | 84.1 | 22.6 | .0076 | 5.57 | .031 |
| 40 | 79.4 | 21.6 | .0089 | 5.33 | .036 |
| 30 | 74.0 | 20.4 | .0105 | 5.03 | .042 |
| 20 | 66.8 | 18.8 | .0126 | 4.64 | .051 |
| 10 | 56.2 | 16.4 | .016 | 4.04 | .065 |

If L be the inductance of the choking coil required to cause a certain reduction in the candle-power, and if R and I be respectively the corresponding resistance of the group of lamps, and the total current through them, then

$$100 = I \sqrt{R^2 + (2\pi \times 50L)^2}.$$

Now the resistance of the filaments does not remain constant, but decreases as the lamps are being dimmed. This can be taken into account thus:—The relationship between the current and the candle-power for metal-filament lamps is given roughly by $C.P. = k_1 I^2$, where k_1 is a constant. From this equation the third and fifth columns in the table have been calculated. The resistances of the lamps in both groups are then found from the ratio of the voltage to the corresponding current, and the inductances are afterwards determined from the expression given above.

The second award (5s.) is given to "L. R." for the following reply, which we have abridged:—

The best method of using choking coils for the purpose suggested depends to a large extent on the effect desired, and the existing switching arrangements. It may be required to have a continuously variable dimming scheme, or a form with two points only, such as lights full on, lights dim. Again, the groups may be controlled by a single switch or by a series of switches.

Assume for the moment that each group has a double-pole switch controlling it. Then probably the most convenient method would be to use an auto-transformer connected across the mains at this switch, and tap off whatever voltage be required to give the desired effect.

With an ordinary metal-filament lamp a reduction of about 5 per cent. in the voltage reduces the candle-power by approximately 15 per cent. A reduction of 10 per cent. lowers it by about 25 per cent., whereas with a reduction of 50 per cent. it only glows. From these figures the kind of voltage change can easily be determined, and one can make two or three tappings if desired.

If an auto-transformer cannot be employed, then a choking coil would be introduced to give a similar voltage drop, and it is quite likely that the standard transformers and chokers

used with alternating current arc lamps can be applied, but that depends on the particular case.

An ordinary 100- to 110-volt transformer of this kind gives 75 volts on the secondary, and the choker reduces this to 42 volts. Such a choker carries anything up to 15 amperes, which seems to be about the correct size in the present case.

Again, it may be possible to use one auto-transformer for supplying the two groups of lights. A standard choking coil with iron core and air-gap can be readily adapted, if not already suitable, by adjusting its air-gap.

REVIEWS OF BOOKS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

The Wireless Telegraphist's Pocket Book of Notes, Formulae, and Calculations. By J. A. Fleming, F.R.S. 347 pp. 7½ in. by 4½ in. 38 figures. (London : Wireless Press, Ltd.) 6s. net; abroad 6s. 3d.

ONE of the most remarkable features of this work is a compressed treatise on mathematics, embracing a vector analysis and many other refinements in tabloid form occupying no more than 54 pages—a task that few would dare attempt. The remainder forms an admirable bridge between mathematics and practice, and discusses the quantitative aspect of high frequency currents and their application in transmitting and receiving circuits, besides giving a host of useful practical information for operators as well as designers, and a selection of conveniently arranged tables.

Experimental Physics. A Text-book of Mechanics, Heat, Sound, and Light. By H. A. Wilson. 405 pp. 8½ in. by 5½ in., 235 figures. (Cambridge : The University Press.) 10s. net; abroad, 10s. 7d.

THE scope of this book is indicated in its sub-title—"A text-book of mechanics, heat, sound, and light." It is intended as a text-book for use in connection with a course of experimental lectures. Although no previous knowledge of physics on the part of the reader is assumed, a thoroughly sound knowledge of elementary mathematics is essential in order to derive the greatest benefit from the book. The principles of the subject are treated accurately, and the experiments described are well chosen; but there is something in the author's style and method which makes the book unnecessarily "hard reading." This will, however, possibly be alleviated when the student can actually see experimental illustrations.

An Introduction to Applied Mechanics. By E. S. Andrews. 316 pp. 9 in. by 5½ in., 205 figures. (Cambridge : The University Press.) 4s. 6d., abroad, 5s 5d.

This differs from the old text-books in that it is much more practical and not merely a treatise of applied mathematics; at the same time, the author has avoided the danger of going to the opposite extreme, as some more recent writers have done, by giving too much engineering application without sufficient explanation of fundamental principles. Among the best features of the book are its excellent diagrams, the numerous worked examples and well-chosen numerical exercises, and concise summaries of the chapters. The whole subject, though copiously illustrated by experiment and example, is treated in a continuous manner, and in logical sequence throughout.

A First Course in Engineering Science. By P. J. Hales and A. H. Stuart. 191 pp., 7 in. by 5 in., 159 figures. (London : W. B. Clive.) 2s. 6d., by post 2s. 9d.

Although not going far enough for the serious student of engineering, this small volume forms a very good popular introduction to the subject. The first part deals with applied mechanics, and the second with heat and the steam engine. The authors have made themselves acquainted with the recent Board of Education Memorandum on engineering teaching in evening schools, and have made a praiseworthy attempt to cover the ground allotted to the first year of the major course of "engineering science," and at the same time to conform with the syllabus of the City and Guilds' examination in Mechanical Engineering, Division I., Grade I.

The Testing of Machine Tools. By G. W. Burley. 231 pp. 7½ ins. by 4½ ins. 110 figures. (London : Scott, Greenwood & Son.) 4s. net; abroad 4s. 4d.

THE treatment of the subject covers the three general sections : (1) shop tests, i.e., tests made to keep up the standard of the machines so far as accuracy is concerned; (2) commercial tests, having as their immediate object the improvement of the output and the general conditions of operation; and (3) scientific and laboratory tests, made for the information of the designer as well as the user. While the book discloses little that is novel to the competent engineer, it undoubtedly contains much useful information on the subject.

THE LIGHTING OF FACTORIES AND WORKSHOPS

A DISCUSSION took place at the meeting of the Illuminating Society on Tuesday, November 23rd, upon the first report of the Home Office Committee on the Lighting of Factories and Workshops. This report was summarised in our issue for September 16th, p. 378, and the discussion was opened by Mr. L. Gaster, who was a member of the Committee. The object of the discussion was to secure from those interested in the matter suggestions for the future guidance of the Committee, which has at present another report in preparation based upon the work already done. Further work, however, is, not unnaturally, for the moment held up.

Mr. Gaster summarised the report of the Committee and put forward a number of points which he considers worthy of further consideration. It is not without interest to point out, however, that although one of the reasons why Government action was secured in this country in this matter was the repeated statements that Governments in many other countries of the world had taken the problem in hand officially, yet the outstanding facts by which the Committee was faced was the absence anywhere in the world of any general provisions in respect of lighting of the kind in question. The report contains a summary of the legislation bearing upon industrial and school lighting in the chief European countries and the United States of America, but many of the regulations were introduced a number of years ago. The result is that the Committee's report can, without exaggeration, be said to be the most complete publication on industrial lighting in the world.

As we have already pointed out, the general recommendation of the Committee was that a minimum of 0·25 ft. candle should at some future date be specified by legislation as the minimum illumination for storage, passages, stairways, &c., leaving the actual working place to be dealt with as a separate problem. Emphasis is laid upon the point that this is the *minimum*, but in many cases the *desirable* illumination might be a good deal higher. From Mr. Gaster's remarks it is clear that there is considerable work still awaiting the Committee as regards the effect of glare, and the avoidance of excessive contrasts in illumination. There is room also for a detailed and systematic study of the requirements in regard to lighting in specific industries, whilst information gained during the past twelve months has shown a definite relationship between illumination and the physical condition of workers. A Department Committee under the auspices of the Home Office and the Minister of Munitions has recently been appointed to deal with the subject, and there is every prospect of co-operation between this Committee and the Factory Lighting Committee.

Several speakers took part in the discussion, and all with one exception were in complete accord with the suggestions and recommendations in the first report. Mr. G. Campbell, however, went so far as to stigmatise the report as a dismal failure from the point of view of its recommendations. He contended that an illumination of 0·25 ft. candle for factory lighting would be totally inadequate for 99 per cent. of cases, and suggested that a minimum of from 1 to 3 ft. candles would not be too much.

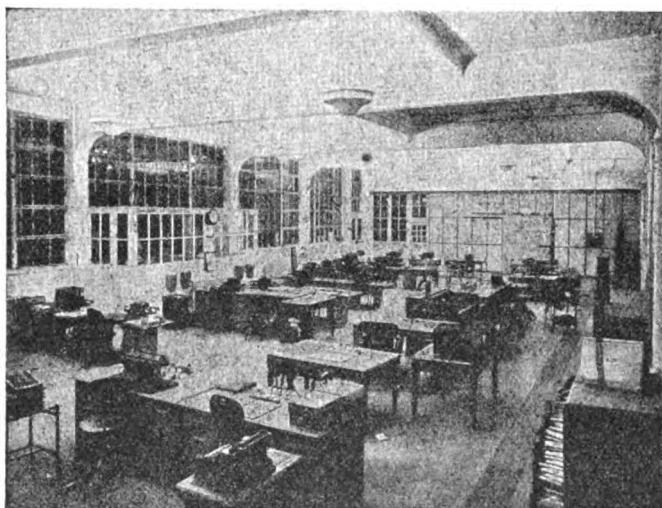
The relationship between fatigue and illumination was mentioned by one or two speakers, but the most interesting speech was that by Mr. A. Cunningham, of the London & South-Western Railway, who dealt with the question of lighting railway goods yards. He contended that 0·25 ft. candle would be an unreasonably high degree of illumination in many railway goods yards, and instanced a 14-acre yard belonging to his Company in which the present lighting is considerably less, although it is ample in his opinion. To increase this to a minimum of 0·25 ft. candle would be to increase the annual cost for current alone from £300 to £1,500. Incidentally, mention may be made of the fact that the Committee propose an exemption clause for special cases, and probably railway goods yards would come within this category.

Summing the discussion up, it may be said that a splendid start has been made by the Committee, and that there is practically no controversy as to the soundness of the views it has already expressed. At the same time, experience goes to show that even now there is room for a considerable amount of educational work amongst factory owners, the examples of badly lighted factories being all too frequent. The best line of argument with such owners, of course, is to impress upon them the intimate relationship between efficient lighting and both the quality and quantity of the output.

The B.E.A.M.A. Annual Dinner.—We are informed that the British Electrical & Allied Manufacturers' Association will not give an annual dinner for the session 1915-1916.

A MODERN LIGHTING INSTALLATION

YET another fine example of thorough efficiency in office lighting arrangements is shown in the accompanying illustration, which depicts the typist's room of the Chiswick Polish Company. The installation has been carried out with Mazda "eye-rest" fittings. In each of the handsome bowls shown



there are five Mazda lamps in separate X-ray reflectors, throwing light on to the white ceiling, whence it is reflected. The quality of this artificial illumination is seen by the fact that the photograph was taken by the artificial light alone, although even the reproduction of the photograph does scanty justice to the actual brilliancy of installation.

OSRAM LAMPS AND THE WAR

THE large response of the electrical industry to the call for recruits has resulted in difficulties for the lamp manufacturer as well as for other departments of electrical enterprise. At the same time, the war has created many special demands for lamps and so encouraged makers to maintain the standard of technical progress and productive efficiency. At the Osram-Robertson Lamp Works (Hammersmith, London, W.), for instance, the management has been able, since the war broke out, to effect a steady improvement all round. Reports of the National Physical Laboratory comment upon the fact that the wattage and candle-power of Osram drawn wire lamps correspond with exceptional accuracy to the standards in each case. This is all the more satisfactory inasmuch as every part of the Osram drawn-wire lamp is produced in this country. The bulbs are produced in Great Britain, and at Hammersmith every process of manufacture is carried out by British workpeople, from the treatment of the tungsten ore to the finished filament, including the making of the supports, hooks, caps, and other details.

"Industries of the Empire Fair."—A preliminary prospectus of the proposed Industries of the Empire Fair to be held at the Palace of Industry, Willesden Green, London, N.W., from March 6th to March 25th, 1917, has been sent to us. The organisers, whose offices are at Lincoln House, High Holborn, W.C., urge British manufacturers to prepare for the position after the war. The Industries of the Empire Fair is not a private enterprise, but is controlled by the principal trade associations of the Empire, which will refund to the exhibitors in the form of a bonus, in the same way as is done with the electrical exhibitions, any profit accruing from the Fair.

The Electric Vehicle Committee.—A note from the Honorary Secretary of the Electric Vehicle Committee comments upon the fact that the Manchester Corporation has recently served notices upon a large number of owners and tenants in that city to abate an alleged nuisance by discontinuing to keep horses on their premises. The obvious bearing of this upon the future of the electric vehicle industry is clear, and Sanitary Committees and other municipal departments are reminded that there is nothing experimental about the modern electric vehicle.

The L. & S.W. Railway Electrification and Telephones.—It is stated that the postponement of the date for the commencement of running the electric train service on the Kingston loop line of the L. & S.W. Railway, announced in our last issue, is due to an alleged interference with the telephone circuits at one portion of the line. Necessary adjustments, however, are being made, and it is hoped that the service will be brought into operation before the end of the year.

LOAN REPAYMENT PERIODS

AS was mentioned in the annual report of the Council of the Institution of Electrical Engineers, the question of obtaining an alteration in the periods at present allowed for the repayment of loans for electrical plant has been under consideration for some time, and the *Journal* of the Institution for December 1st reproduces correspondence which has passed between the Council and the President of the Local Government Board on the matter. The Institution asked for a period of 30 years for all classes of underground mains, instead of the present 25 years for the solid system, 15 years for armoured cables laid direct in the ground, and 20 years for armoured cables coated with jute and bitumen and covered with bricks. It was further suggested that in the case of cables drawn into substantially constructed conduits, the cost of the latter, and of laying them, should be spread over a period of sixty years. For storage batteries 15 years was suggested instead of the present 5 years, and for reinforced concrete work 30 years instead of the present 15. At the same time it was suggested that a deputation should wait upon the President of the Local Government Board.

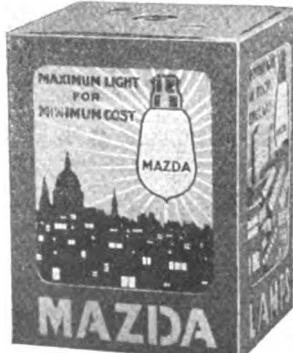
The reply from the Local Government Board, which was dated August 10th last, stated that it was not thought a deputation was necessary. With regard to underground cables it was pointed out that the period has been recently altered to 25 years for all types, and no longer period can be allowed. As to conduits, the Institution's proposal of 60 years was not assented to, but the Board will be prepared to grant 30 years in suitable cases when asked for. The present period of 5 years for storage batteries is to be increased to 7 years, but the Board will not make any alteration in the present period for reinforced concrete work.

LUNDBERG SWITCHES

WE have received from Messrs. A. P. Lundberg & Sons (477-489 Liverpool Road, London, N.) a copy of the handsome and well-printed 4to volume of some 90 pages, which constitutes their new List No. 1. Notwithstanding its size, the list deals only with four of the firm's many types of Tumbler and other small switches—namely, "Single Way," "Twinob," "Double Pole," and "Triple Pole," the prices of "Two-Way" switches being also given. The book contains over 200 illustrations, and a considerable portion of it deals with the thirty or so different kinds of single-way switch and modifications thereof. These thirty kinds are divided into five groups, viz., tumbler, turn, push and pull, pendant, and miscellaneous, and as regards modifications it may be mentioned that the "pivot" switch, for example, can be supplied with one or more of about ten different modifications in its standard construction. As usual with the Lundberg publications, extreme care has been taken in the arrangement, the diagrams of circuits which are given being exceedingly helpful. The dimensions also are given both in inches and millimetres, and the full range of catalogue numbers renders ordering from the list free from any possible misunderstanding.

A MAZDA LAMP SHADE

THE British Thomson-Houston Co. (Mazda House, 77 Upper Thames Street, London, E.C.) have designed the lamp shade shown in the accompanying illustration to assist in carrying out the existing lighting regulations. One of the main objects in view was to deal with railway carriages upon lines running underground for any considerable part of their journey. These Mazda shades are now to be seen, among



others, on the Great Western and Metropolitan Joint Railway, between Hammersmith and New Cross. They are of rectangular construction, one side being opaque and the other three framing transparencies of the very effective design reproduced. The new shade is also available for use in contractors' and dealers' windows, or in conjunction with the Mazda revolving shade, the new type forming a splendid advertisement, besides serving a utilitarian purpose under present conditions.

CATALOGUES, PAMPHLETS, &c., RECEIVED

FACTORY HEATING.—A combined steam heater and electric propeller fan system for factory heating is described in a folder from the Ventilating Engineering Dept., General Electric Co. (67 Queen Victoria Street, E.C.). The unit comprises a battery of cast-iron gilled radiators enclosed in a strong sheet-steel casing, at the top of which is mounted an electric propeller fan fitted to a continuous- or alternating-current motor, the current consumption being approximately 220 watts. The fan blows the air downwards through the heater and distributes it near the floor level.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

CARBON FILAMENT LAMPS.—A two-page pamphlet from Pope's Electric Lamp Co. (Hythe Road, Willesden, N.W.) deals with carbon filament lamps. The company will be pleased to supply to, and overprint for, trade customers in quantities.

TENDERS INVITED AND PROSPECTIVE BUSINESS

In consequence of certain restrictions placed upon technical papers by the Press Bureau, it is not possible, during the present war conditions, to give our readers as much information as hitherto in these columns.

Generating Stations, Sub-Stations, Mains, &c.

Australia.—The Deputy Postmaster-General, Sydney, requires 3,750 common battery, automatic wall pattern telephones; 300 common battery table pattern telephones; 150 wall sets, magneto telephones; and 50 portable telephones. Dec. 20th. Also a common battery multiple switchboard for six subscribers' sections. January 19th.—The Deputy Post-Master-General, Brisbane, requires telephone instruments, parts, and accessories. January 26th.

The Metropolitan Board of Water Supply and Sewerage, Sydney, requires electrically-driven centrifugal pumps. Dec. 20th.

This information is only useful to firms having agents who can be instructed by cable, but copies of specifications, &c., may be seen at 72 Basinghall Street, S.W.

The Berrigan (N.S.W.) Council proposes to instal an electric power station. The name and address of the consulting engineer is on file at 73 Basinghall Street, E.C.

Wiring

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

Brighouse.—New mill. Architect, E. C. Brooke, Central Chambers.

Hitchin.—New premises for Capital & Counties Bank, Ltd., corner of Brand Street.

Miscellaneous

Australia.—The Footscray (Victoria) Council contemplates the installation of electric trams. The name of the consulting engineer is on file at 73 Basinghall Street, E.C.

New Zealand.—The Public Service Stores Tender Board, Wellington, N.Z., requires 6,700 telephone cords and 120 miles of rubber-insulated twin twisted wire. Further particulars at 73 Basinghall Street, E.C.

Diesel Engine Association.—At the November meeting of this Association questions relating to income-tax assessment and allowance for depreciation of Diesel engine plant, price of fuel oil, and cracked and seized pistons were discussed. We will deal more fully with the meeting in our next issue. The next meeting of the Association will be held on the 20th inst.

LOCAL NOTES

Belfast: *Loans Refused.*—The Treasury has intimated to the Corporation its inability to sanction any further loans for mains and services. Consequently, the Electricity Committee will be unable to accept any new applications for supply.

Blackpool: *Threatened Strike of Employees.*—Practically the whole of the employees of the Corporation recently threatened to strike unless increases of wages were granted. After consideration of the position by the Sub-Committee, it has been decided by the men to accept a bonus of 2s. for those earning up to 30s. per week, and 1s. for all earning between 30s. and 35s. The men are also to have a bonus not paid since May owing to a misunderstanding.

Dublin: *The Wiremen's Dispute.*—Although a short time ago it was stated that the dispute between the wiring contractors of Dublin and their employees had, so to speak, come to an end automatically by reason of the fact that many of the men had obtained employment in munitions factories, there has nevertheless been an arbitration, over which the Recorder of Dublin has presided. The present rate is 9d. per hour, but the men demanded an increase of 1½d., as well as a war bonus. The arbitrator's decision is that the men should be granted an increase of 1d. per hour, making 9½d., but an addition of 6d. per day is to be paid to men engaged on War Office work.

Explosion in Sub-station.—There appears to have been a very serious explosion in a Corporation sub-station only a few hundred yards away from the Ringsend power station on Saturday. At the moment the cause of it has not been definitely ascertained. There seems no electrical theory to account for it.

Gravesend: *High-Tension Supply.*—The feature of the past year's working of the electricity undertaking has been the inauguration of high-tension A.C. supply. Hitherto, direct current only has been available. There was a net surplus of £827 for the year, notwithstanding £1,378 extra cost of coal, higher wages, and war allowances.

Liverpool: *Increased Charges.*—An increase of 12½ per cent. in the charges for electricity is recommended, to start in the new year.

London: Poplar: *The "Contract" System.*—The Electricity Committee states that it cannot recommend any reduction, notwithstanding the reduced lighting regulations, in the fixed charge per kilowatt to consumers who are upon the contract system, either for inside or outside lighting.

Manchester: *Output of Electricity.*—At the last meeting of the Electricity Committee it was stated that the output of the Department in the preceding week was the record of 720,000 units, whilst the maximum load on the undertaking during that period was 55,000 kw. It was further stated that difficulties are still being experienced in the matter of coal supplies, the amount received from the contractors being very much below that contracted for. The consequence is that there has had to be recourse to the reserve supplies.

Middlesbrough: *The Electric Transporter Bridge.*—An interesting point was mentioned at the last meeting of the Corporation in connection with the energy consumption of the electrically-driven transporter bridge across the Tees. It was stated that whereas during a given period on a calm day only 87 units were used, during a similar period on another day with a strong wind blowing this was increased to 184 units.

Wirral: *Electric Supply.*—An application by Messrs. Johnson & Phillips for the Council's permission to apply for an electric lighting Provisional Order has been adjourned for a month.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £98 10s. to £99 10s. (last week, 497 10s. to £98 10s.).

Competition.—The recent offer of two guineas for a suitable house name for the new premises of the Electrical Supplies Co. at 233 Tottenham Court Road, London, W.C., brought in nearly 200 names. The judges, after considerable discussion, eventually decided that "The Light House" was the most

suitable for the purpose, and as no fewer than six competitors submitted this same name it was decided, in consequence of this unexpected development, to increase the prize from two to three guineas to enable each successful competitor to receive the sum of half-a-guinea. The names and addresses of those who sent in "The Light House" will be sent to anyone interested.

Agencies.—The *Board of Trade Journal* points out that a British engineer in Moscow desires to represent United Kingdom manufacturers of dynamos, electric lifts, &c. Further particulars at 73 Basinghall Street, E.C.

A Johannesburg agent desires to represent United Kingdom manufacturers of electrical fittings, wires, &c. Further particulars at 73 Basinghall Street, E.C.

Brazil.—According to the *Board of Trade Journal* there is an urgent demand for electric lighting appliances among other goods in various States in Brazil. Further particulars are available at 73 Basinghall Street, but it is pointed out that the districts referred to are full of German settlers and traders.

Trade with New Zealand.—The Commercial Intelligence Branch of the Board of Trade is notified that the Wellington (N.Z.) Chamber of Commerce is organising an exhibition of goods of British manufacture to be held during one week in February next. It is suggested that British firms who are unable to supply the New Zealand market at the present time, either at all or on the same terms as previously, should endeavour to keep their names before the public, not only by participating in the exhibition, but also by carrying out a campaign in the local Press, pointing out exactly why their goods are not obtainable at the moment, or why they are perhaps higher in price.

Dissolution of Partnership.—The partnership between P. L. Dwyer and P. R. Winterson, trading as P. L. Dwyer & Co., electrical manufacturers and suppliers, 66 Victoria Street, London, S.W., has been dissolved. P. W. Dwyer continues.

APPOINTMENTS AND PERSONAL NOTES

The appointment of Mr. R. H. Scotson, Electrical Engineer to the Middlesbrough Corporation at a salary of £300 per annum is recommended. We reported a short time ago that Mr. H. M. Taylor, the Borough Electrical Engineer hitherto, had received a commission in H.M. Forces. It is stated, however, that the matter of this appointment is to be raised before the Council meeting.

Works Manager for motor and electrical engineering factory in the Midlands. (See advertisement on another page.)

The Bennett College require Tutor in electrical department. (See advertisement on another page.)

Oldham Electricity Department want a Shift Engineer. (See an advertisement on another page.)

Canterbury Electricity Works want a Switchboard Attendant. (See an advertisement on another page.)

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

"Z" Electric Lamp Mfg. Co.—Mr. Justice Astbury, in the Chancery Division on Wednesday last week, sanctioned a reduction in the capital of this Company from £150,000 to £15,000. During the course of the proceedings it was stated that the chief loss was in respect of the value of the Company's patents.

Durham Electrical Power Distribution Co.—The capital of this Company was reduced from £500,000 in £5 shares to £300,000 in £1 shares in the Chancery Division on Wednesday last week. It was stated that capital to the extent of at least £200,000 has been lost or is unrepresented by available assets, a position said to be due to the vast changes in the methods of electrical generation and distribution since the Company was incorporated in 1899.

Arrangements for the Week.—*Fri., Dec. 3rd.* "The Generators." Dinner at Trocadero. 6.15 p.m.

Wed., Dec. 8th. Institution of Electrical Engineers. Yorkshire Section. Philosophical Hall, Leeds. "Some Difficulties of Design of High-speed Generators," by Prof. A. B. Field. 7 p.m.

Association of Engineers-in-Charge. St. Bride's Institute, Bride Lane, E.C. "Ammunition Manufacture." By A. E. Perin. 8 p.m.

TRADES DIRECTORY OF

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(One Free Entry is given to every Advertiser.

Entries under additional headings, 6d. per insertion.)

ACCESSORIES (Electric Light and General Supplies).

- Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.
 E. S. Co., Ltd., 53, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Guibert-Martin, 9, Edmund Place, E.C.
 Haslam & Stretton, Ltd., 11, Windsor Place, Cardiff.
 Holophane, Ltd., 12, Carteret St., Westminster, S.W.
 Lundberg (A. P.) & Sons, Liverpool Rd., N.
 Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
 Simpson (C. M.), 4, St. Augustine's Place, Bristol.
 Sun Electrical Co., Ltd., 118, Charing Cross Rd., W.C.

ACCUMULATORS, &c.

- D.P. Battery Co., Ltd., Bakewell, Derbyshire.
 Hart Accumulator Co., Ltd., Marshgate Lane, Stratford.
 Naylor Battery Co., 1, Lammermoor Rd., Balham, S.W.
 Tudor Accumulator Co., Ltd., 3, Central Buildings, Westminster.
ARC LAMPS, CARBONS, AND ACCESSORIES.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London Electric Firm, Croydon.
 Oliver Arc Lamp, Ltd., Cambridge place, Burrage Rd., Woolwich.

ARMATURE REPAIRS.

- Marryat & Place, 28, Hatton Garden, E.C.

BOILERS.

- Babcock & Wilcox, Ltd., Oriel House, Farringdon St., E.C.
 Stirling Boiler Co., Ltd., 54, Victoria St., S.W.

CABLES, WIRES, AND DUCTS.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Glover (W.T.) & Co., Trafford Park, Manchester.
 Henley's (W.T.) Telegraph Works Co., Ltd., Blomfield St., E.C.
 Hooper's Telegraph & Indiarubber Works, Millwall Docks, E.
 Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
 Morshead (L. R.) & Co., 17, Victoria St., S.W.
 St. Helens Cable & Rubber Co., Ltd., Warrington.
 Siemens Bros. & Co., Ltd., Woolwich.
 Union Cable Co., Ltd., Dagenham Dock, Essex.

CATALOGUES AND PROCESS ENGRAVING.

- Swain (John) & Son, Ltd., Shoe Lane, E.C.

COIL WINDING.

- Varley Magnet Co., Ltd., Cambridge Place, Burrage Rd., Woolwich.
COMMUTATOR CEMENT.

- Godfrey & Co., 54, Lower Thames St., E.C.

CONDENSERS (Electrical).

- Telegraph Condenser Co., Ltd., Vauxhall St., Kennington Oval, S.E.
DYNAMOS see Motors and Dynamos.

FLEXIBLE METALLIC TUBING.

- United Flexible Metallic Tubing Co., Ltd., 112, Queen Vict. St., E.C.
GLASSWARE.

- Mountain (Hugh), 104, High Holborn, W.C.

HEATING AND COOKING APPARATUS.

- Belling & Co., Derby Rd., Edmonton, N.
 British Thomson-Houston Co., Ltd., Rugby.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Ferranti, Ltd., Central House, Kingsway, W.C.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London Electrical Trading Co., Ltd., 185, Wardour St., W.C.

INSTRUMENTS.

- Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick.
 Ferranti, Ltd., Central House, Kingsway, W.C.
 General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 Nalder Bros. & Thompson, Ltd., 97a Dalston Lane, Dalston, N.E.
 Record Electrical Co., Ltd., Caxton House, Westminster, S.W.
 Weston Electrical Instrument Co., Audrey House, Ely Place, E.C.

INSULATING VARNISH, ENAMELS, PAINTS**AND LACQUERS.**

- Blume (Chas. H.), The White Building, Sheffield.
 Fredk. Crane Chemical Co., Armoury Close, Birmingham.
 Griffiths Bros. & Co., Macks Rd., Bermondsey, S.E.

INSULATORS AND INSULATING MATERIALS.

- Macintyre (J.) & Co., Ltd., Burslem.
 Mosses & Mitchell, 122 to 124, Golden Lane, E.C.
 Weidmann (H.) Ltd., Rapperswil, Switzerland.

INSURANCE.

- Phoenix Assurance Co., Ltd., 19 & 70, Lombard St., E.C.

LADDERS.

- Heathman & Co., 10, Parsons Green, S.W.

LAMPS (Incandescent).

- British Thomson-Houston Co., Ltd., 77, Upper Thames St., E.C.
 Cryseco, Ltd., Kempston Works, Bedford.
 Dick, Kerr & Co., Ltd., Abchurch Yard, E.C.
 Drake & Gorham, Ltd., 66, Victoria St., S.W.
 Edison & Swan United Elec. Light Co., Ltd., Ponders End, Middlx.

LAMPS (Incandescent)—contd.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.
 London & Rugby Engineering Co., Ltd., 36 & 37, Queen St., E.C.
 Pope's Electric Lamp Co., Ltd., Hythe Rd., Willesden, N.W.
 Siemens Bros. Dynamo Wks., Ltd., 39 Upper Thames St., E.C.
 Simplex Conduits, Ltd., 113 to 117, Charing Cross Rd., W.C.
 Stearn Electric Lamp Co., Ltd., 47, Victoria St., S.W.

LAMP FILAMENTS.

- Gmur & Co., Ltd., Aarau, Switzerland.

LEAD, &c.

- Capper, Pass & Son, Ltd., Bedminster Smelting Works, Bristol.

LIFTS.

- Waygood-Otis, Ltd., Falmouth Rd., S.E.

MECHANICAL STOKERS.

- Underfeed Stoker Co., Ltd., Coventry House, South Place, E.C.

METAL PERFORATORS.

- Harvey (G. A.) & Co. (London), Ltd., Woolwich Rd., London, S.E.

METERS.

- Bastian Meter Co., Ltd., Kentish Town, N.W.

- British Thomson-Houston Co., Ltd., Rugby.

- Ferranti, Ltd., Central House, Kingsway, W.C.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

MICA.

- British Mica Co., Ltd., Lebanon Rd., Works, Wandsworth, S.W.

- Wiggins (F.), & Sons, 102 to 104, Minories, E.C.

MINE EQUIPMENTS AND APPARATUS.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Peebles (Bruce) & Co., Ltd., Edinburgh.

- Reyrolle & Co., Ltd., Hebburn-on-Tyne.

- Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.

- Willans & Robinson, Ltd., Rugby.

MOTORS AND DYNAMOS.

- British Thomson-Houston Co., Ltd., Rugby.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.

- Fair (W. D.) & Co., 43, Leicester Square, London, W.C.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Matthews & Yates, Ltd., Swinton, Manchester.

- Peebles (Bruce) & Co., Ltd., Edinburgh.

- Siemens Bros. Dynamo Works, Ltd., Caxton Ho. Westminster, S.W.

- Vickers, Ltd., River Don Works, Sheffield.

OIL CANS.

- Kaye (J.) & Sons, Ltd., Lock Works, Leeds.

PUMPING PLANT.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Merryweather & Sons. Fire Engine Works, Greenwich, S.E.

- Willans & Robinson, Ltd., Rugby.

REPAIRS.

- Marryat & Place, 28, Hatton Garden, E.C.

RUBBER GLOVES.

- Ingram (J. G.) & Son, Hackney Wick, N.E.

- Moseley (D.) & Sons, Ltd., Ardwick, Manchester.

STEAM ENGINES AND TURBINES.

- Allen (W. H.) Son & Co., Ltd., Queen's Engineering Works, Bedford.

- British Thomson-Houston Co., Ltd., Rugby.

- Dick, Kerr & Co. Ltd., Abchurch Yard, E.C.

- J. Howden & Co., Ltd., 195, Scotland St., Glasgow.

- Vickers, Ltd., River Don Works, Sheffield.

- Willans & Robinson, Ltd., Rugby.

STEAM ENGINE ACCESSORIES.

- Lea Recorder Co., Ltd., 32, Deansgate, Manchester.

- United States Metallic Packing Co., Ltd., Bradford.

SWITCHGEAR.

- British Thomson-Houston Co., Ltd., Rugby.

- Dorman & Smith, Ltd., Ordsall Electrical Works, Salford.

- Drake & Gorham, Ltd., 66, Victoria St., S.W.

- Electric Control, Ltd., 177, Reid St., Bridgeton, Glasgow.

- Ellison (George), Warstone Lane, Birmingham.

- Ferranti Ltd., Central House, Kingsway, W.C.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Record Electrical Co., Ltd., Caxton House, Westminster, S.W.

- Reyrolle & Co., Ltd., Hebburn-on-Tyne.

TECHNICAL BOOKS.

- Caxton Publishing Co., Clun House, Surrey St., Strand, W.C.

- Constable (Archibald) & Co., Ltd., 10, Orange St., Haymarket, W.

- Crosby Lockwood & Son, 7, Stationers' Hall Court, E.C.

- Macmillan & Co., Ltd., St. Martin's Street, W.C.

TELEPHONES.

- General Electric Co., Ltd., 67, Queen Victoria St., E.C.

- Gent & Co., Ltd., Faraday Works, Leicester.

- Graham (Alfred) & Co., St. Andrew's Works, Crofton Park, S.E.

- Siemens Bros. & Co., Ltd., Woolwich.

- Western Electric Co., Ltd., North Woolwich, E.

WIRING CONTRACTORS. See page iv.**WOODWORK CASING AND CONDUITS.**

- Jennings & Co., Pennywell Rd., Bristol.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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SUMMARY

FURTHER reference is made to the Annual Report of H.M. Electrical Inspector of Factories. A number of miscellaneous matters are also dealt with, including lead poisoning in accumulator factories, the lighting of factories, and the electrical disposal of dust and fumes (p. 490).

WE give the complete list, to Nov. 20th, of those members of the Institution who have lost their lives fighting (p. 491).

A NEW lamp has been developed in which an arc burns between tungsten electrodes in a bulb containing an inert gas. It has an efficiency of half a watt per candle, a life of several hundred hours, and the light is emitted from almost a point. The size of the bulb is smaller than that of a half-watt incandescent lamp. Lamps are about to be made from 200 to 2,000 c.p. (p. 492).

AMONG the subjects of specifications published by the Patent Office last Thursday are water-tight bells, metal filaments, telegraphy, cables, and electro-magnetic switches. Opposition has been entered to an engine starter patent and withdrawn from an indicating electric moving-target patent.—A patent for an A.C. automatic signalling system expires this week after a full life of 14 years (p. 493).

OUR Questions and Answers page this week deals with the welding of copper wires by the use of welding transformers (p. 493).

AN interesting discussion took place at the last meeting of the Diesel Engine Users' Association on the subject of cracked and seized pistons (p. 494).

ARRANGEMENTS are being made for finding capital at

Marylebone to continue hiring out apparatus; electrical fittings are required by the Brighton and West Ham Guardians; quantities of telephone apparatus in Australia; and electricity generating plant at Manchester and Aberdeen (p. 495).

THE Marylebone Electricity Department will not allow more employees to enlist. Practically the whole of the staffs at Bristol and Burnley have attested.—An emergency supply involving a kw. charge of £12,000 has been arranged between the Marylebone Electricity Department and the Central Electric Supply Co.—The question of the excess profits tax in relation to municipal undertakings has been discussed at Manchester (p. 496).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

(To-day) Thurs., Dec. 9th: Sections I. and II., shooting.

Fri., Dec. 10th: Sections III. and IV., technical. Sections I. and II., squad. Signalling section and recruits.

Sat., Dec. 11th: Instruction class at 2.30 p.m.

Mon., Dec. 13th: Sections I. and II., technical. Sections III. and IV., squad. Signalling sections and recruits.

Tues., Dec. 14th: School of Arms with Architects Corps, 6.0 to 8.0 p.m.

Thurs., Dec. 16th: Sections III. and IV., shooting.

Fri., Dec. 17th: Sections III. and IV., technical. Sections I. and II., squad. Signalling sections and recruits.

Sat., Dec. 18th: Uniform parade. Time and place to be posted at headquarters later.

Sun., Dec. 19th: Trench digging for Sections I. and II. Parade at Victoria Station—time to be announced later.

Sections for technical parade at Headquarters, London Electrical Engineers, 46 Regency Street, S.W.

Sections for shooting parade at miniature ranges.

Unless otherwise ordered, all parades at Chester House.

(For "Arrangements for the Week" see p. 496.)

SUBSCRIPTION RATES.

The postage on ELECTRICAL ENGINEERING is unaffected by the new postal regulations, and the subscription for the United Kingdom is as hitherto, 6s. 6d. per annum, post free.

REDUCED SUBSCRIPTION RATES FOR COLONIES AND ABROAD.

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ELECTRICAL ACCIDENTS IN POWER STATIONS AND FACTORIES

(Concluded from p. 479.)

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Fig. 1 shows (diagrammatically) a lamp constructed on this principle. The positive lead is connected to the tungsten electrode E through a steady resistance and a relay, C. Before the lamp is switched on, the secondary contacts of this relay are closed, and a current passes through the ionising filament B B'. This ionises the gas around E, and a small current passes from E to the ioniser and back to the negative pole; this current gradually increases until the cut-out relay is operated, breaking the ioniser circuit, and "striking" the arc. The sequence of operations is not quite complete at this point, as, if the arc remained at the same part of the filament at which

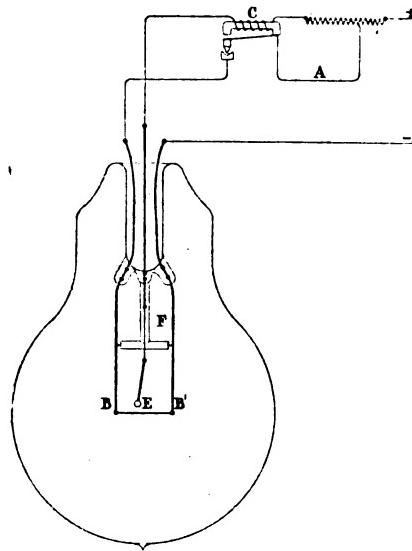


FIG. 1.

the arc was struck, it would soon destroy the ionising properties of the filament. The expansion strip F is therefore retained, and, as it is warmed by the heat rising from the arc, it warps and moves the electrode E to another position on the filament. In this lamp practically the whole of the intense white light emanates from the small globule of tungsten E, about one-tenth of an inch in diameter.

For lamps of larger candle-power, the expansion strip is dispensed with, the filament is placed vertically, and the electrode is in the form of a small plate, the edge of which faces the filament. After the arc strikes, it rises to the upper part of the filament, which is closer to the plate and thickened. In another method there is a fourth lead through the stem of the lamp, holding a smaller electrode fixed between the positive plate

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AFTER carbon had been regarded for many years as the only material for filaments of incandescent lamps, it was superseded by the metal tungsten, and the efficiency of the lamp was improved three-fold. While it is too soon to prophesy a similar development in arc lamps, yet the first step has been taken, and a lamp has been successfully developed at the Ediswan laboratory at Ponders End in which the source of light is an arc between tungsten electrodes. In spite of the enormous increase in the value of carbons since the outbreak of the war, tungsten is still the more precious material, and it would, of course, be out of the question to burn the metal away in the atmosphere in an open arc. The arc therefore burns in an inert gas, such as nitrogen or argon, and the lamp is contained in a glass bulb of the same shape and size as that of an incandescent lamp.

An ingenious method is employed to strike the arc. To employ in a closed incandescent lamp bulb an ordinary arc lamp series coil and electromagnetic mechanism would be hardly feasible, and it was found that a thermal expansion strip made up of two metals with different coefficients of expansion did not move with sufficient speed to prevent the electrodes sticking together or spluttering. An incandescent filament, especially if, instead of being of pure tungsten, it is composed of that metal in combination with refractory oxides, such as zirconia, yttria, or thoria, has powerful ionising properties, and such a filament is employed to ionise the gas in the gap between the electrodes, so that the arc can strike across.

Fig. 1 shows (diagrammatically) a lamp constructed on this principle. The positive lead is connected to the tungsten electrode E through a steady resistance and a relay, C. Before the lamp is switched on, the secondary contacts of this relay are closed, and a current passes through the ionising filament B B'. This ionises the gas around E, and a small current passes from E to the ioniser and back to the negative pole; this current gradually increases until the cut-out relay is operated, breaking the ioniser circuit, and "striking" the arc. The sequence of operations is not quite complete at this point, as, if the arc remained at the same part of the filament at which

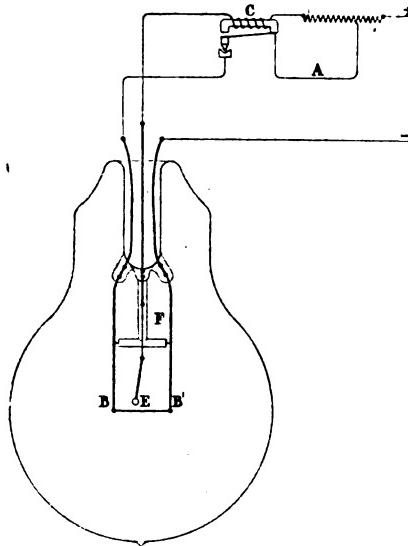


FIG. 1.

the arc was struck, it would soon destroy the ionising properties of the filament. The expansion strip F is therefore retained, and, as it is warmed by the heat rising from the arc, it warps and moves the electrode E to another position on the filament. In this lamp practically the whole of the intense white light emanates from the small globule of tungsten E, about one-tenth of an inch in diameter.

For lamps of larger candle-power, the expansion strip is dispensed with, the filament is placed vertically, and the electrode is in the form of a small plate, the edge of which faces the filament. After the arc strikes, it rises to the upper part of the filament, which is closer to the plate and thickened. In another method there is a fourth lead through the stem of the lamp, holding a smaller electrode fixed between the positive plate

and the filament, and situated at a definite distance from the former. By the operation of change-over switches in the circuit an arc is first struck between the filament as cathode and the small electrode as anode. On this electrode becoming brightly incandescent the change-over switch quickly operates, and brings into the circuit the large plate electrode, at the same time breaking the negative connection to the filament and changing the polarity of the small white-hot electrode. This latter now being negative, an arc is immediately formed between it and the large positive plate. This arrangement enables electrodes of any size to be used, and the filament being out of the circuit is completely protected.

A flat electrode is also employed. To obtain the best results a definite relation of surface to volume must be maintained. This type of lamp is made in sizes of 500 to 1,000 candle-power, the maximum intensity being given in a direction at right angles to the plane of the electrode.

In the same way that a carbon lamp appears yellow in comparison with the ordinary half-watt lamp, so does the latter appear yellow when contrasted with the new incandescent arc. For high candle-power lamps the bulbs are much smaller than for metal-filament lamps of corresponding candle-power, e.g., electrodes to give 500 candle-power can be placed with safety in a bulb 4 in. in diameter.

Curve A (Fig. 2) shows the percentage variation of pressure with current. As will be seen, the curve is similar to that for an ordinary carbon arc, though showing greater stability. The pressure across the arc steadily decreases with an increase of current, and if continued until the sputtering point is reached, the pressure suddenly drops.

A representative efficiency curve is given by B in Fig. 2, which shows the efficiency for the normal working current to

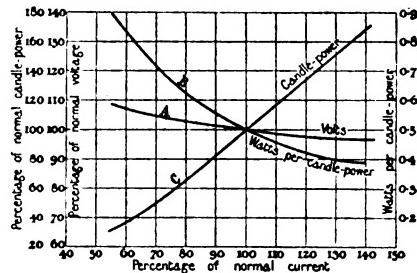


FIG. II.

be about 0.5 watt per International candle-power, or 2 candle-power per watt. The current may be increased until the tungsten reaches the sputtering point, at which the efficiency is about 0.3 watt per candle-power or 3.33 candle-power per watt.

Curve C in Fig. 2 shows the variation of candle-power with current.

Lamps have been made with a life of 500 hours, and it is hoped that further experiment will make it possible to obtain a true half-watt lamp with a life of 800 hours. During life the average decrease in candle-power is about 10 per cent. Some experiments to determine the effect of varying the pressure across the supply mains showed the arc to be very stable. A voltage drop of 20 per cent. in the case of the small lamps, and 25 per cent. in the larger sizes, was necessary before the arc was extinguished.

As compared with the carbon-filament lamp (3.5 watts per candle-power) with an intrinsic brilliancy of about 375 candle-power per sq. in., and metal-filament lamps giving 1,000 candle-power per sq. in., the intrinsic brilliancy of the new lamp at an efficiency of 0.5 watt per candle-power, or 2 candle-power per watt, is approximately 10,000 candle-power per sq. in. The colour of the light can be made to vary from a bright yellow when running at low efficiencies, to a very intense white light when the lamp is run to the sputtering point of the electrodes. The range of intrinsic brilliancy between these limits is approximately 400 to 30,000 candle-power per sq. in.

The above descriptive particulars of the new lamp, which, we understand, may very shortly be placed upon the market, are taken from a very modest Paper by E. A. Gingham and S. R. Mullard, printed in the number of the *Journal of the Institution of Electrical Engineers* just issued.* The Paper also contains some interesting photographs comparing the spectrum of this lamp with those of others. It is evident that the light is almost perfectly white, that it extends further at the

red end of the spectrum than the 1½-watt tungsten lamp, and does not show the same weakness in green rays. It should therefore be excellent for colour-matching. Moreover, it extends far into the ultra-violet, and should be useful for photographic purposes. The main utility for special purposes will be, however, for projection work—both for ordinary lanterns and cinematographs. The makers are also developing an examination lantern for surgical purposes, which should ultimately displace the troublesome Nernst lamp, hitherto the most popular for this, but practically unobtainable since the outbreak of the war. A range of candle-power from 200 to 2,000 is contemplated, so that, as soon as circumstances permit its more complete development, it should have a large applicability for general purposes as well as the special uses mentioned.

CORRESPONDENCE

THE INSTITUTION AND ALIEN ENEMY MEMBERS.

To the Editor of ELECTRICAL ENGINEERING.

SIR,—Many members of the I.E.E. consider that the Council should be approached with a view to removing from the list of membership those individuals who are alien enemies.

My own opinion is that the members of the I.E.E. should prepare their protest outside the Institution, and, if they feel justified, present it to the Council. I should be pleased to hear from any members sharing my views with the object of taking speedy action.

Yours, etc.,
W. ELLERD-STYLES.

Grafton House, Golden Square, W..
Dec. 7th, 1915.

Obituary: Thomas Parker.—By the death of Mr. Thomas Parker at his home at Ironbridge, Shropshire, on Sunday, at the age of 72, another of the founders of the electrical industry in this country has passed away. He was one of the first to show the incandescent lamp here in 1882, and about the same time took up, in conjunction with Elwell, a patent for the manufacture of accumulators. This partnership with Elwell developed into a business for the manufacture of electrical machinery generally, the firm subsequently being changed into the Electric Construction Co. Mr. Parker was responsible for the lay-out of the original works on the present site at Bushbury. He left this concern in 1894, and founded Thos. Parker, Ltd., at Wolverhampton, which achieved a high reputation as manufacturers of electrical machinery. When in turn he retired from this undertaking (now Reed Roturbo, Ltd.), Mr. Parker entered into private consulting work. In addition to his manufacturing interests, Mr. Parker was responsible for many of the original lighting and traction systems in this country. He also sat with Dr. H. F. Parshall as one of the umpires (with the late Hon. Alfred Lyttelton as arbitrator) to determine the system of electric traction to be adopted by the Inner Circle Railway in London. At that time there had been much controversy as to the merits of the 600-volt continuous-current third-rail system, which Dr. Parshall may be said to have represented, and the high-tension overhead three-phase system, then being developed by Messrs. Ganz & Co., of Budapest, the use of which Mr. Parker advocated.

Foreign-owned Companies.—The position of companies in this country owned or mainly owned by enemies has recently been the subject of renewed discussion in various parts of the country, and a question on the matter was put to the Government in the House of Commons on Monday. It was stated in reply, however, that the present position of these companies—namely, that being registered in this country they have all the privileges of English companies, with the proviso that no profits are to be paid over to enemy shareholders during the war—will continue for the present, but that consideration is being given to the question whether any steps shall be taken after the war to prevent the registration of companies the majority of whose shares are under foreign control.

Women Electricians.—At a meeting of the Liverpool branch of the Electrical Contractors' Association last week, a discussion took place as to the steps to be taken to fill the deficiency caused by electrical works being engaged on war work. Eventually the following resolution was passed: "That in the opinion of this meeting of the Liverpool branch of the Electrical Contractors' Association it is advisable in the interests of the country that a certain number of women should be trained in various branches of electrical work to ensure that the country's commercial work shall not suffer through the war, and this shall be strictly without prejudice to the electricians who have enlisted. . . ."

* For convenience of readers who are not members of the Institution, we shall be pleased to send copies of this number of the *Journal* to any address in the United Kingdom or abroad post free at the published price of 3s. 6d. The number also contains the full text of Mr. C. P. Sparks Presidential Address (an abstract of which appeared in ELECTRICAL ENGINEERING of Nov. 25th), an excellent photograph portrait of Mr. Sparks and Mr. B. Welburn's Address on the Production and Properties of Electrolytic Copper (briefly reported in our issue of Nov. 1st). Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203, Temple Chambers, London E.C. and should be accompanied by a remittance.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 2nd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

21,536/14. **Bells.** J. BEIN. A watertight electric bell in which the magnet coils project through the case; the hammer is wholly outside, and the terminals are inside. (Four figures.)

22,551/14. **Metal Filaments.** E. R. GROTE and W. H. REYNOLDS. A binder for making tungsten filaments by the squirting process, consisting of gelatinous aluminium hydrate in conjunction with a solution of tungstic acid or other tungsten compound.

22,265/14. **Telegraphy.** MUIRHEAD & CO., LTD., and G. O. SQUIER. A submarine cable telegraph system in which messages are transmitted by an unbroken alternating current, the dots, dashes, and spaces being represented by variations in amplitude of each successive half-wave obtained by introducing resistance or impedance into the cable circuit, under control of a perforated strip. (Five figures.)

2,289/15. **Cables.** W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., and H. SAVAGE. A system of clamping cables with smooth rubber sheathing in fittings, glands, &c., depending upon the provision of a collar or protrusion of tough india-rubber securely united to the sheathing. (One figure.)

3,837/15. **Electromagnetic Switches.** IGRANIC ELECTRIC CO., LTD. (*Cutter Hammer Mfg. Co., U.S.A.*). An electromagnetic switch comprising a movable switch element with mechanical means for latching it in a predetermined position, and an electromagnet having an armature moving the switch to this position when attracted, and another armature to trip the latch, so arranged in the magnetic field that, until the switch armature is attracted, the latching armature cannot be acted upon. (Four figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Arc Lamps: GIMINGHAM [Arc-incandescent lamps] 22,437/14.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: SOC. CERAMICA RICHARD-GINORI [Insulators] 24,631/14; SMITH [Cables] 7,675/15.

DYNAMOS, MOTORS, AND TRANSFORMERS: FOSTER & SHARP [Controlling variable-speed dynamos] 1,474/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Induction motors] 3,502/15.

Electrometallurgy and Electrochemistry: JENKINS, PATTINSON, and WELLESLEY [Electrolytic cells] 22,867/14; BUCHER [Electrical production of cyanides] 23,292/14.

Heating and Cooking: BRITISH ELECTRIC HEATER CO. and KRATT [Sterilisers] 22,720/14; GROGAN [Heating elements] 23,676/14.

Switchgear, Fuses, and Fittings: PICKERINGS, LTD., and FOTHERGILL [Controllers] 24,108/14; HOUGH and HARRISON [Fittings] 2,928/15.

Telephony and Telegraphy: RELAY AUTOMATIC TELEPHONE CO. and AITKEN [Automatic and semi-automatic telephone systems] 22,715/14; AUTOMATIC TELEPHONE MFG. CO. (Automatic Electric Co., U.S.A.) [Telephone hand sets] 23,282/14.

Traction: HUGHES and PAYNE [Train stop] 16,558/14; W. R. SYKES INTERLOCKING SIGNAL CO. and SYKES [Train stop] 22,328/14; MIDGLEY and VANDERVELL [Engine-starters] 7,206/15.

Miscellaneous: MAITRE and MARTIN [Contact-breaker] 7,692/14; GALVANOPHOREN-WERKE (*System Vogt*), S. SZUBERT, KOMMANDITGESELLSCHAFT & VEREINIGTE ELEKTRICITÄTSWERKE, GES. [Condensers] 22,931/14; HARLAND & WOLFF, LTD., and BENTLEY [Steering-gear] 569/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Distribution Systems, Cables, Insulators, &c.: SIMONSEN [Insulators] 15,192/15.

Heating: LANDIS & GYR A.G. [Heating device] 15,685/15.

Miscellaneous: LINCOLN [Indicators] 15,128/15.

Opposition to Grant of Patents

Opposition has been entered to a grant on the following application:—

24,293/14. **Engine Starter.** A. H. MIDGLEY and C. A. VANDERVELL. An electric starter for motor-car engines in which the motor pinion is formed on a nut travelling on its shaft, and moves into mesh with the gear ring on the engine by its screw action, springing back automatically when no torque is being transmitted.

Opposition to the following has been withdrawn:—

16,148/13. **Targets.** J. R. QUAIN. Electrically worked self-indicating moving targets.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:—

25,175/01. **Railway Signalling.** J. B. STRUHLE. A system of automatic signalling employing alternating currents.

The following are the more important Patents that have become void through non-payment of renewal fees.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: R. K. GRAY [Cable conductors] 17,283/08.

DYNAMOS, MOTORS and TRANSFORMERS: H. A. MAVOR and MAVOR & COULSON [Ventilating ducts for dynamo armatures and transformers, &c.] 18,343/06.

Storage Batteries: H. C. HUBBELL and H. FULLER [Storage battery plates] 17,331/08.

Switchgear, Fuses and Fittings: A. E. G. [Time switches] 18,486/06.

Traction: A. W. GATTIE and A. G. SEAMAN [Electrical clearing house goods distribution system] 17,344/08.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,472.

When replacing an E.H.T. 3-phase switch (which had accidentally been tripped) it was noticed that the reading on the switch ammeter went up to nearly 20 amps., and then gradually died down to almost zero. The current was switched on to two transformers, a 100 and a 50 k.v.a. respectively. What would cause the momentary excessive rise in current? On another occasion, when switching in, there was no rise whatever on the ammeter beyond the transformer current. Is such a rise in any way bad for the transformer from a practical or theoretical point of view?—H. H.

(Replies must be received not later than first post, Thursday, Dec. 16th.)

ANSWERS TO No. 1,470.

We have occasion to make good welded joints in copper wires of all sizes, from the smallest up to $\frac{1}{8}$ in. square. Would a "welding transformer" be suitable for this? If so, what is the

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

arrangement made for adjusting the current to the right value for various sizes of wire?

The first award (10s.) is given to "L. R." for the following reply:—

The method suggested is quite correct for welding joints in copper wires, and is, in fact, largely used. The process commonly goes by the name of the Thomson process, and the apparatus generally used commercially consists essentially of an alternating-current generator, a welding transformer transforming from about 300 volts to 1 volt, the latter being the voltage of the secondary or welding circuit, and electrical regulating apparatus to control the supply of current. The ends of the secondary, which is practically a solid copper block forming a single turn, are provided with suitable clamps directly mounted thereon. These hold the materials to be welded, and pressure devices enable pieces of metal to be forced together by end-pressure, thus making a butt weld when the requisite temperature is reached.

In moderate size machines the operation of welding is performed by hand, that is to say, the smith operating watches the metal, and when he considers the welding temperature is attained, he applies end-pressure by means of a hydraulic jack, switches off the current from the primary, and removes the article from the clamps for swaging.

In the case of smaller materials, such as wires, an automatic welder is usually employed. The Electric Welding Company market an apparatus for this special purpose, operating on the lines described above. The article is held by the clamps on the ends of the secondary, one clamp always being pressed towards the other by means of a spring. When the metal becomes soft enough at the point of contact, this clamp advances, an automatic trigger switch then comes into action, and cuts off the current from the primary directly a good amount of upset has been obtained. Welding in this way is now used to a large extent even for very small copper wires.

A similar machine is made by the British Insulated & Helsby Cables Co., Ltd., for welding copper wires from the smallest size up to the exact dimension stated, namely, $\frac{1}{8}$ ths of an inch. The alternating-current dynamo used with it generates 100 volts. The switches and regulating arrangements in the primary circuit permit complete and delicate control.

Welds made according to this method are certainly good, their strength being greater than hand-made welds. A slight burr is formed, which is not considered objectionable, but it can readily be removed if necessary.

In some cases a resistance formed in a number of sections is used in the primary circuit for regulating, and again in others a reactive coil is employed which has two windings, so that they can be used separately or joined in series or in parallel. In this way a considerable range is secured, and ensures satisfactory welding even for the smallest wires.

The essentials for successful welding in practice are, that the pressure must be comparatively light, that is, only just sufficient to force the burnt metal out of the weld; the metal must be allowed actually to fuse at the joint, and the current should be cut off the moment the wires are squeezed together at the proper welding temperature.

Variation of the cross-section of the wires changes the power required and the time during which the current is applied.

The following gives an approximation of the figures employed in some cases:—

| Square inch section of copper. | Watts in primary. | Seconds. |
|--------------------------------|-------------------|----------|
| 0·125 | 6,000 | 8 |
| 0·25 | 14,000 | 11 |
| 0·375 | 19,000 | 13 |
| 0·5 | 25,000 | 16 |
| 1 | 49,000 | 23 |

No second award is made.

The Students' Section, I.E.E.—The 1915-16 session of the Students' Section of the Institution of Electrical Engineers will be opened to-night (Thursday) by an address by Mr. J. E. Kingsbury (Hon. Treasurer) on "The Institution." The following Papers have been arranged on Wednesday nights as follows: Dec. 15th, A. G. Ramsey, "The Aluminium Electrolytic Arrester, with an Introduction on Electrical Disturbances"; Feb. 2nd, P. R. Coursey, "The Methods employed for the Wireless Communication of Speech"; Feb. 16th, W. J. Jones, "The X-Ray Tube and Modern Practice"; March 1st, discussion on "Suggested Applications of Science to Warfare"; March 15th, E. T. Driver, "Long-distance Transmission Lines"; March 29th, annual general meeting.

DIESEL ENGINE USERS' ASSOCIATION

AT the November meeting of the Diesel Engine Users' Association, held at the Institution of Electrical Engineers, a number of matters were discussed. The Acting Hon. Secretary reported the names of further undertakings and firms who had joined in the movement to endeavour to obtain more favourable terms from the inland revenue authorities in the matter of the allowance off profits for depreciation of Diesel engine plant before assessment for income-tax purposes. In this connection it was pointed out that the present inadequate allowance of only 5 per cent. on the diminishing or written down value of the plant corresponded to an assumed life of 58 years for Diesel engines if the residual value of the plant at the end of the term was taken to be 5 per cent. of the original value. The allowance of 15 per cent. recommended by the Association as fair and reasonable under the circumstances corresponded to an assumed life of 18 years for the plant.

After a short discussion on the serious increase in the price of fuel oil, the discussion on the subject of cracked and seized pistons was resumed by Mr. J. M. Ferguson. He spoke of the practice and experience of Messrs. Willans & Robinson, Ltd., on these points, and laid stress on the great importance of using metal of the special quality necessary for pistons of Diesel engines. The casting should be carried out in the engine-maker's own foundry, under his direct control and supervision.

Mr. P. H. Smith also spoke, and remarked that the fundamental cause of cracks in Diesel engine pistons is a highly heated core trying to expand, but being restricted in so doing by a comparatively cold and very stiff ring of metal surrounding it. This action being progressive, fractures inevitably occurred. It was noticeable, he said, that Diesel engines working continuously day and night gave very little trouble from cracked pistons as compared with other similar engines working more intermittently. Some makers were endeavouring to find a cast-iron for pistons which would not "grow" on repeated heating and cooling. Such an iron is very pure, high in manganese and low in silicon, but, being mainly of Swedish origin, is practically unobtainable at the present time. At the same time, Mr. Smith did not think that the ultimate solution of the trouble of cracked pistons would be found in the adoption of any particular grade of cast iron. After discussing the two general systems of piston construction which have found favour in the case of larger sizes of pistons—namely, pistons with renewable heads and water-cooled pistons—the speaker described a renewable core in the piston head, devised by himself to overcome the trouble of cracking. In the larger sizes of pistons the difficulty is not only to avoid cracking, but seizure, and, said Mr. Smith, all Diesel-engine pistons exceeding 16 ins. diameter should be water-cooled or oil-cooled if the mean effective pressure is as high as 95 to 100 lb. per sq. in. Other speakers took part in the discussion. The next meeting will be held on December 20th.

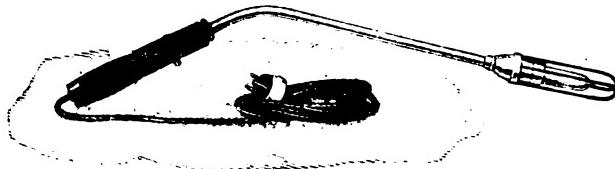
Harmonics in Oscillograms.—A useful contribution to the theory of the operation of the Duddell oscillograph is made by Professor G. W. O. Howe, in a communication published in the I.E.E. Journal. This Paper is the result of an investigation into the accuracy of the amplitude and phase of the ripples in the potential-difference wave of alternators as recorded by the oscillograph. It has been previously shown by the author that the ripples due to the teeth of an alternator should be symmetrical with respect to the fundamental when the machine is on open circuit and there is no dissymmetry in the magnetic field. Many oscillograms, however, showed the ripples to be unsymmetrical, and the question arose as to whether the oscillograph was to blame. Professor Howe shows, by calculation of the magnitude and phase displacement of various harmonics for different degrees of damping, that the change produced mechanically by the oscillograph in the amplitude and phase position is negligible for harmonics of a frequency up to 0·2 of the resonant frequency of the oscillograph, which covers most usual cases in practice.

Shrinking Vectors.—Just as an ordinary alternating current can be represented by a rotating vector of constant length, so a damped oscillation can be represented by a rotating vector of continually diminishing length. A mode of studying damped oscillations by means of "shrinking vectors" is described by Prof. David Robertson in a long communication published in the I.E.E. Journal. The author shows how damped oscillations can be represented by these vectors, and how the equations for such oscillations can be deduced from the vectors almost as easily as those for ordinary alternating currents.

County of London Co.'s War Bulletin.—The second number of the County of London Electric Supply Co.'s War Bulletin gives a list of additional members of the staff who have joined the forces. At the same time we cannot but express regret that the list of those killed in action and wounded increases. The Bulletin is designed to appeal to the staffs, not only of the County of London Electric Supply Co., but its associated companies, the Bournemouth and Poole, the Richmond (Surrey), and the Coatbridge and Airdrie Electric Supply Co. The various letters from the front which are given make most interesting reading.

SIMPLEX SHELL INSPECTION LAMP

THE shell inspection lamp illustrated has been introduced by Simplex Conduits, Ltd. (Garrison Lane, Birmingham). Apart from its robust construction, which makes it particularly suitable for the strenuous usage of munitions factories, it is



provided with an "earth" wire. The lampholder is insulated from the body, and both holder and lamp cap are protected and cannot be touched by the operator as long as the guard is in position. The lamp shown, if used with an "earthing" plug, has the approval of the Home Office.

CATALOGUES, PAMPHLETS, &c., RECEIVED

POPE'S LAMP SHADE.—Pope's Electric Lamp Co., Ltd. (Hythe Road, Willesden, N.W.), is the latest to bring out an advertising lamp shade which will be found useful to those firms wishing to shade their lighting in accordance with the police instructions. A supply of these will be sent to any buyer or seller of electric lamps on application.

STEAM PUMPS.—A pamphlet which will be useful to all users of steam pumps is issued by Willans & Robinson, Ltd. (Rugby), describing Willans-Oddie simplex direct-acting steam pumps. These pumps have the advantageous feature, found in but few other types, that the functions of auxiliary valve, shuttle piston, and main valve are performed by one single piece, and it is claimed that in the Willans-Oddie pump this single combined valve is completely balanced, the unbalanced parts of the valve being exposed to exhaust steam only. A detailed description, with diagrams, of the action of the pump is given, as well as illustrations of pumps for various classes of service, including boiler-feed and hydraulic pumps, air pumps, mine and donkey pumps, forced lubrication pumps, &c., with dimensions, capacities, and code words of standard sizes. A useful section is devoted to notes on the arrangement and fitting up of pumps, setting valve gear, starting up and shutting down, running, replacing of spare parts, of which a list is given, &c. The pamphlet concludes with a table of metric equivalents of the makers' standard pump dimensions.

TENDERS INVITED AND PROSPECTIVE BUSINESS**Generating Stations, Sub-Stations, Mains, &c.**

Aberdeen.—The City Electrical Engineer has presented a report, in which he recommends extensions to the generating plant at an estimated cost of £21,175.

Doncaster.—It is reported that the load on the Balby to Hexthorpe high-tension feeders has reached the limit allowed by the Board of Trade and the question of adding to the capacity is under consideration.

Ilford.—The Electricity Department requires 1,200 yards of conduit. Borough Electrical Engineer. Dec. 15th. (See advertisement on another page.)

London: Islington.—The L.G.B. has approved of the proposal to adapt the present installation at Highgate Hill Infirmary so that current can be taken from the Islington Borough Council as long as the cost does not exceed £500 and is paid for out of revenue.

Marylebone.—The Marylebone Electricity Committee has been considering the steps to be taken so that the Department may be in the financial position to continue the hiring of apparatus to consumers. It is recommended that the Council should advance to the Electricity Committee for twelve months from December 30th the sum of £5,156 for this purpose, interest to be charged at the rate of 5 per cent. per annum, which is now the amount charged by the L.C.C. in respect of municipal loans.

Manchester.—A special report has been prepared dealing with a temporary scheme for increasing the output of electricity pending the completion of the new Barton power station.

Miscellaneous

Australia.—The Deputy Postmaster-General, Melbourne, requires a supply of electrical measuring instruments, telephone parts, and 500 automatic common battery telephones. Further particulars at 72 Victoria Street, S.W. Tenders by Jan. 4th. This information, of course, is only of use to firms who can cable agents.

Brighton.—A supply of electrical fittings for the Guardians. Dec. 14th. Clerk, Princes Street.

Durban.—The Telephone Department of the Corporation requires telephone apparatus and materials and underground telephone cables. Particulars from Messrs. Webster, Steel & Co., 5 East India Avenue, E.C., by whom tenders will be received up to Dec. 31st.

West Ham.—Three months' supply of electrical fittings for the Guardians. Dec. 16th. Clerk, Union Road, Leytonstone, N.E.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £97 10s. to £98 10s. (last week, £98 10s. to £99 10s.).

Agencies.—H.M. Trade Commissioner in Australia reports that a Sydney agent wishes to represent United Kingdom manufacturers of electrical machinery and apparatus, particularly wire-drawn lamps. Further particulars at 73 Basinghall Street, E.C.

APPOINTMENTS AND PERSONAL NOTES

Alderman Duncan Watson has been re-appointed Chairman of the Marylebone Electric Supply Committee.

The Generating Station Engineer at Marylebone, Mr. T. K. Richardson, being absent on sick leave, Mr. Leonard, Chief Station Assistant, has been appointed to carry out the duties with a temporary increase in his salary to £350 per annum.

During the absence of Mr. Harold Gray, the Borough Electrical Engineer, who is serving with the Accrington and Burnley Howitzer Brigade, the Acting Engineer is to be paid an extra remuneration of £100 per annum from the date of Mr. Gray's enlistment.

Mr. M'Kee, Distributing Engineer in the Belfast Electricity Department, has resigned.

A Works Manager is required for a motor and electrical engineering factory in the Midlands. (See advertisement on another page.)

The Royal Holloway College requires a Resident Engineer. (See advertisement on another page.)

A Wireman is required for a large hospital. (See advertisement on another page.)

INGRAM'S INDIA-RUBBER GLOVES and GAUNTLETS FOR ELECTRICAL PURPOSES

NON-CONDUCTING.

**BEST QUALITY
INDIA-RUBBER.**



**Made in
all sizes of
Ordinary & Stout
Substances
to suit varying
Voltages.**

Prices on Application.

**Manufacturers—
J. C. INGRAM & SON, Hackney Wick, LONDON, N.E.**

LOCAL NOTES

Belfast: *The Fire at the Power Station.*—The insurance claim for damages in respect of the recent fire at the electricity works (ELECTRICAL ENGINEERING, Sept. 2nd, p. 368) has been settled for £3,809. In reporting this, the Electricity Committee referred to the dismissal of the Resident Superintendent (Mr. Farrell), who, however, is said to have instituted legal proceedings against the Corporation.

Public Lighting.—In order to relieve the demands upon the electricity undertaking arrangements are being made for a reversion to gas for street lighting. In adopting this step the Electricity Committee remarks that this does not mean that the lamps will be sent to the scrap heap, but that when normal times are restored the City will return to electricity for street lighting.

Restriction of Electric Supply.—Consumers have been asked to reduce, as far as possible, their consumption of electricity between 4 p.m. and 5.30 p.m. At the same time the local electrical contractors have had the position of the Corporation in regard to capital expenditure explained. Owing to the refusal of the L.G.B. to grant loans, as already reported in our columns, the development of the undertaking as far as private consumers are concerned is being more or less held up, a position which, of course, affects the wiring contractors to a considerable extent.

Bristol: *Recruiting Results.*—Out of the total staff of 301 engaged in the Bristol Corporation Electricity Department, of whom 177 are married and 124 single, no less than 194 have volunteered, and 144 have been accepted. There are actually 77 members of the staff serving, the remainder being either in Reserve B under Lord Derby's scheme or in the Naval Reserve. Fifty men have been rejected, 70 are over age, 16 under age, and three are physically unfit. Thus it will be seen that the employees of the Bristol Electricity Department have not failed in their duty to their country.

Burnley: *Electricity Staff Enlistment.*—Out of the 26 employees of the Electricity Department eligible for military service, 25 have attested under Lord Derby's scheme, including the Borough Electrical Engineer, Mr. J. E. Starkie. They will not, of course, be called upon for immediate service.

London: L.C.C.: Tramway Supply.—In March this year the Council approved an estimate of £11,800 for cables in connection with a reserve supply of power for the tramways from an outside source. The contemplated agreement, however, fell through, and at present inquiries are being made with a view to obtaining a supply from elsewhere. Thus this cable is available for some other purpose, and it is proposed that part of it shall be utilised in the Woolwich district, where there is a constantly increasing demand for additional cars.

Marylebone: Enlistment.—The General Manager has been authorised to refuse any further permission for employees of the Department to enlist, on the ground that the staff is now at the very lowest level at which efficient working can be maintained.

Training Faraday House Students.—Arrangements have been made with Faraday House by which a number of fourth-year pupils will go to the electricity works for one year's practical training, the College paying the Council £25 per annum for each pupil.

Emergency Supply.—Consent has been given to arrangements with the Central Electric Supply Co. for taking an emergency supply should this be needed owing to damage to the Council's generating station by enemy aircraft. The connecting link between the Council's system and that of the Central Electric Supply Co. has now been completed and tested. In the event of this service being required by the Council, it would be necessary to pay the Company £12,000 by way of kw. charge. Insurance has been effected against this contingency at exceptionally favourable rates.

Manchester: Tax on Municipal Trading.—The Parliamentary Sub-Committee has had under consideration that portion of the Finance Bill dealing with excess profits duty. A resolution has been adopted to the effect that municipal undertakings should be excluded from the operation of this portion of the Bill, or in the alternative that all municipal undertakings in a town should be consolidated and treated as one, the excess profit duty being charged on the total profits after allowing for losses on any of the undertakings.

Street Lighting.—The responsible authorities have given permission for an increase in the present restricted lighting of the streets. It is the fact that only a short time ago the lighting in Manchester was considerably less than in London, but a certain improvement has been allowed. Now it appears

that still more lighting is to be permitted, at any rate, for at least two hours after sunset.

Nuneaton: *Curtis Geared Turbine.*—About a year ago the B.T.-H. Co. supplied the Corporation with a 750 kw. geared Curtis turbo-generator. This set has operated so satisfactorily that an order has been placed for a duplicate.

Sheffield: *Kelham Island Power Station.*—Steps are to be taken to transfer the Kelham Island power station from the tramways undertaking to the electric supply undertaking. A short time ago it will be remembered that the whole of the supply to the tramways was placed in charge of the electric supply department, Mr. H. E. Yesbury, the Tramways Electrical Engineer, going over to the Electricity Department as Assistant Engineer. Thus the proposed transfer is a purely formal matter.

Arrangements for the Week.—(To-day) Thurs., Dec. 9th. Institution of Electrical Engineers. Students' Section. Victoria Embankment. "The Institution," by J. E. Kingsbury. 7.45 p.m.

Fri., Dec. 10th. Greenock Electrical Society, 19 West Stewart Street. "Electric Tramways," by J. Punch. 7.45 p.m.

Sat., Dec. 11th. Birmingham Electric Club. Swan Hotel, New Street. Annual General Meeting. 7 p.m.

Mon., Dec. 13th. Institution of Electrical Engineers. Western Section. "The Design of High Pressure Distribution Systems," by J. R. Beard. S. Wales Institute of Engineers. Park Place. 5.30 p.m.

Tues., Dec. 14th. Institution of Electrical Engineers. Manchester Section, Engineers' Club. Albert Square. "The Design of High-pressure Distributing Systems," by J. R. Beard. 7.30 p.m.

Institution of Electrical Engineers, Scottish Section. Princes Street Station Hotel, Edinburgh. "Electric Heating: its Present Position and Future Development," by G. Wilkinson. 8 p.m.

Institution of Electrical Engineers, Birmingham Section. The University. "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks," by J. D. Morgan. 7 p.m.

Institution of Civil Engineers. "James Forrest" lecture. "Electrical Railways," by H. M. Hobart. Mr. J. A. F. Aspinall will read the lecture. 5.30 p.m.

Illuminating Engineering Society at Society of Arts, John Street, Adelphi. Discussion on "Recent Developments in Electric Incandescent Lamps in relation to Illuminating Engineering." 8 p.m.

Association of Supervising Electricians. St. Bride's Institute, Bride Lane, E.C. "Electric Lifts," by H. Marryat. 7.15 p.m.

Wed., Dec. 15th. Institution of Electrical Engineers. Students' Section. Victoria Embankment, E.C. "The Aluminium Electrolytic Arrester, with an introduction on Electrical Disturbances," by A. G. Ramsey. 7.45 p.m.

Thurs., Dec. 16th. Institution of Electrical Engineers. "The Design of High-pressure Distribution Systems," by J. R. Beard. 8 p.m.

Fri., Dec. 17th. Electro-Harmonic Society. Holborn Restaurant. Smoking Concert.

Institution of Mechanical Engineers, at Institution of Civil Engineers. "Engineering Colleges and the War," by Dr. R. Mullineux Walmsley and C. E. Larard. 6 p.m.

Music-hall Electricity.—"Dr." Walford Bodie was the defendant in an action in the Birmingham County Court last week in which a tailor's presser, suing for damages, alleged that he had been injured during a music-hall performance which "Dr." Bodie was carrying out. The plaintiff apparently went on to the stage in reply to an invitation by the defendant, and was asked to hold a handle attached to a battery as part of the "turn." It is alleged, however, that the plaintiff got a very severe shock, and had to go to hospital. As "Dr." Bodie is at present in South Africa, the hearing of the case was fixed for a date in April. We have some recollection that a few years ago this music-hall performer styled himself a hypnotist, mesmerist, bloodless surgeon, and medical electrician, and that in connection with a successful action for the return of £1,000 premium paid by a pupil, some very pointed remarks as to the genuineness of the show were made by Mr. Justice Darling. Some even stronger comments were made subsequently in the Appeal Court.

Tungsten Lamp Selling Prices.—The December issue of *The Electrical Contractor* states that a conference is now going on between the Electrical Contractors' Association and the Tungsten Lamp Association with regard to certain details which are regarded as in need of adjustment in connection with the sale of tungsten lamps.

The Electrical Industry and the Ministry of Munitions.—In the House of Commons on Monday Dr. Addison, speaking on behalf of the Ministry of Munitions, gave a list of business men, scientific experts, and employers of labour who are giving their services gratuitously to the Ministry. These include Sir Alexander Kennedy, Prof. Sir J. J. Thomson, F.R.S., Prof. Bernard Hopkinson, Sir George Marks, M.P., Mr. A. H. Pooley, Dr. S. Z. de Ferranti, Mr. W. H. Maw, Sir Hiram Maxim, Mr. S. S. Moore Ede, Sir Henry Norman, and Mr. A. J. Walter, K.C.

ELECTRICAL ENGINEERING

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SUMMARY

THE United States Navy has ordered two battleships of the largest and most powerful class, which are to be electrically propelled (p. 498).

WE give an illustrated description of a 750 kw. D.C. geared turbo-generator, the successful trial of which at Nuneaton has resulted in a repeat order being given (p. 499).

RECRUITS are wanted for the Wireless Section (R.E.) and also for the Artists Rifles (O.T.C.) (p. 500).

NOTES on the working of the Liverpool Overhead and Mersey Railways formed the subject of Papers read at the Liverpool Engineering Society (p. 500).

OUR Questions and Answers page this week deals with the choice of a suitable frequency for proposed extensions to an existing mine installation (p. 501).

AMONG the subjects of specifications published at the Patent Office last Thursday were a new "arc incandescent" lamp with tungsten electrodes in an inert gas, condensers, and induction motors (p. 502).

MR. H. F. PARSHALL pays a tribute to the broad-mindedness which always characterised the late Mr. Thomas Parker (p. 502).

A SHORT article describes an interesting office electric-heating installation (p. 503).

THE Aberdeen extension scheme is to be deferred. Extensions are to be carried out at Redditch (£12,542) and Nuneaton (£10,000); mains are required at Burton-on-Trent (£3,500) and Hackney £3,000; and two electrically driven centrifugal pumps at Sydney (p. 503).

IT is stated that the British Carbide Co. is transferring its works from Norway to Manchester.—Whilst the whole of the fitters at the Luton Electricity Works were away attesting, a mechanical stoker broke down and caused an interruption in the supply (p. 504).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

(To-day) Thurs., Dec. 16th: Sections III. and IV., shooting.

Fri., Dec. 17th: Sections III. and IV., technical. Sections I.

and II., squad. Signalling sections and recruits.

Sat., Dec. 18th: Uniform parade. Time and place to be posted at headquarters.

Sun., Dec. 19th: Trench digging for Sections I. and II.

Mon., Dec. 20th: Sections I. and II., technical. Sections III.

and IV., squad. Signalling section and recruits.

Tues., Dec. 21st: School of Arms with Architects, 6-7 p.m.

Thurs., Dec. 23rd, to Thurs., Dec. 30th, inclusive.—Headquarters closed.

Fri., Dec. 31st.—Social evening, 6.15 to 8.15.

Sat., Jan. 1st: Uniform parade.

Officer of the Week: Monday, December 20th, to Saturday, January 1st, Mr. Corbett.

Platoon on Duty: Monday, December 20th, to Saturday, January 1st. No. 2 Platoon.

Platoon on duty has to provide a picquet for H.Q. of one N.C.O. and three men, and also one N.C.O. for instructing recruits.

Sections for technical parade at Headquarters, London Electrical Engineers, 46 Regency Street, S.W.

Sections for shooting parade at miniature ranges.

Unless otherwise ordered, all parades at Chester House.

The Osram v. Pope Patent Action.—Judgment was given yesterday in the appeal by the Osram-Robertson Lamp Works, Ltd., against the judgment of Mr. Justice Joyce that the metal filament lamp process worked by Pope's Electric Lamp Co., Ltd., does not infringe the Osram lamp patents. Lords Justice Warrington and Bankes held that the appeal must be dismissed with costs. The Master of the Rolls was not present. We will deal more fully with the judgment next week.

(For "Arrangements for the Week" see p. 503.)

SUBSCRIPTION RATES.

The postage on ELECTRICAL ENGINEERING is unaffected by the new postal regulations, and the subscription for the United Kingdom is as hitherto, 6s. 6d. per annum, post free.

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ELECTRICALLY-PROPELLED BATTLESHIPS To be Used in the U.S. Navy

AN extremely interesting announcement to electrical engineers was made in last Saturday's *Times*, namely, that the two battleships ordered to be built in the U.S. Government yards in accordance with the American programme of 1915 are to be electrically propelled. They will be equipped on the same lines as the *California*, which was laid down on October 14th last, and will be the first vessels in the world of the battleship class in which electric propulsion is employed.

A description of the equipment of the *California*, which is also being built in the U.S. Government yards, was given in a Paper read before the American Society of Naval Architects and Marine Engineers by Mr. W. L. R. Emmett last month, and reported in this country in the *Shipbuilding and Shipping Record* of November 25th. The contract for the electrical-propelling machinery for this battleship, which is of the largest and most powerful class adopted by the U.S. Navy, was awarded to the General Electric Co. Her displacement is 32,000 tons, and her maximum speed is to be about 22 knots, requiring about 37,000 s.h.p. The contract with the General Electric Company covers two turbine-driven generating units, four propelling motors (one for each shaft), switching apparatus, cables, instruments, &c., two turbine-driven exciting units, and a complete equipment of condensing auxiliaries and ventilating blowers, all driven by motors from the exciting units. In fact, it covers practically the entire engine-room equipment except the main condensers.

Each of the auxiliary units is of 800 kw. capacity with a 240-volt D.C. generator geared to a high-speed, non-condensing turbine. These turbines will exhaust into the heaters, into the main turbines, or both. The motors which drive the auxiliaries will be designed for a considerable range of speed variation, so that the auxiliaries will be adaptable to economical conditions at different speeds of the ship.

The award of this contract was the result of a very long "campaign of education," which had been conducted by Mr. Emmett, in which the equipment of the collier *Jupiter* was an incident. The *Jupiter* has now been in commission for two years, and has proved an unqualified success. The steam consumption of the main drive with 190 lb. pressure, dry steam, and 28.5 in. vacuum is 11 lb. per h.p.-hour delivered to the propeller shafts, which is at least 30 per cent. better than is done by reciprocating engines in ships of this class. There is also evidence of further saving in the *Jupiter*, incident to the fact that her large low-speed propellers are turned with a perfectly uniform angular motion and with entire freedom from racing, conditions heretofore unknown with such propellers.

The generators for the *California* are bipolar alternators, and the motors are arranged to be connected either for 24 poles or 36 poles. For economic cruising at 15 knots or less, one generator will be used with motors on 36-pole connection. For higher speeds the 24-pole connection will be used. The ship will be capable of operating at a speed of about 18.5 knots with one generator.

Speed variation with either motor connection will be effected by change of turbine speeds through the agency of variable speed governors designed to hold automatically any desired speed within usual ranges. This arrangement, which is also used in the *Jupiter*, entirely prevents racing, and makes it convenient to hold a fixed speed, irrespective of variations in sea, weather, or steam conditions. It is thought that this feature will be valuable in fleet formations.

The steam consumption guaranteed on the *California* covers the total steam required for the main turbines and engine-room auxiliaries as described above. The conditions are 250 lb. gauge pressure, dry steam, with such vacuum as can be produced under trial conditions. The guaranteed water rates per horse-power delivered to the propeller shafts are as follow:—

| | Lb. |
|-------------------------------|------|
| At 10 knots | 14.6 |
| At 15 knots | 11.4 |
| At 19 knots | 11.1 |
| Maximum speed | 11.9 |

Very heavy penalties are imposed in case these guaranteed consumptions are exceeded in trials, \$25,000 per lb. for the two lower speeds and \$20,000 per lb. for the two upper speeds.

At full speed the *California* propellers will make 175 r.p.m., this being about the lowest speed of propellers which is practicable within the space. The propeller speeds proposed

for the sister ships with Parsons turbine drive is 240 r.p.m., and comparisons by Dyson's method indicate that this speed difference will give the *California* an advantage of about 9 per cent. in propeller efficiency.

The following table gives a comparison of steam consumption per effective horse-power between the *California* as guaranteed, the *Florida* and *Utah* which are driven by Parsons turbines, and the *Delaware*, which is driven by reciprocating engines. These figures are taken from the published records of trials.

POUNDS OF STEAM TO MAIN ENGINES PER HOUR PER EFFECTIVE HORSE-POWER.

| | 12 kts. | 15 kts. | 10 kts. | 21 kts. | Prop. speed. 21 kts. |
|-----------------------|---------|---------|---------|---------|-------------------------|
| <i>Florida</i> ... | 31.8 | — | 24.0 | 23.0 | 328 |
| <i>Utah</i> ... | 28.7 | — | 20.3 | 21.0 | 323 |
| <i>Delaware</i> ... | 22.0 | — | 18.7 | 21.0 | 122 |
| <i>California</i> ... | 17.3 | 15.2 | 15.0 | 16.4 | 175 |

The estimated weight of the propelling machinery without condensing auxiliaries is 530 tons, and that of the turbines originally proposed was 653 tons.

Comparing the arrangement of the machinery of the *California* with the *Utah*, and a geared turbine equipment for a large warship shown in a paper by Sir Charles Parsons read in March of 1913, Mr. Emmett drew attention to the simplicity of piping, steam and vacuum connections with the electric drive as compared with the other methods. The *California* has two turbines, the *Utah* has 10, and the proposed Parsons geared equipment has 32. All of the steam passages between turbines in these arrangements, the author added, involve loss of useful pressure, and many of them involve risk of vacuum loss through air leakage, for it must be remembered that ships are often subject to vibration, and that there may be appreciable relative motion of these different parts through expansion strains or working of the ship, or through their own inertia when the ship is vibrating or labouring in a seaway.

It will be remembered that the collier *Jupiter* was put through a most severe test. She made a cruise from San Francisco to Philadelphia through the Panama Canal, and completed the trip in 23 days. During the war with Spain the *Oregon* made this trip from San Francisco to Philadelphia, via the Straits of Magellan, in 66 days, reaching Cuban waters in time to take part in the battle of Santiago. At the laying of the *California*'s keel Mr. Daniels said that the combination of electric drive and oil fuel would enable this vessel at 10 knots speed to steam for nine days longer than a coal-burning Dreadnought, and during that time she could cruise more than 2,150 miles farther.

NEW PUBLICATIONS

We shall be pleased to post any of the undermentioned works to any address in the United Kingdom, Colonies, or Abroad at the prices given. Orders should be addressed to the Kilowatt Publishing Co., Ltd., 203-6 Temple Chambers, Temple Avenue, London, E.C., accompanied by a remittance.

"Test Methods for Steam Power Plants." By E. H. Tenney. 224 pp. 8*1*/₂ in. by 5 in. 85 figures. (London: Constable and Co., Ltd.) 10s. 6d. net; abroad 11s.

"British Standardisation Rules for Electrical Machinery (excluding Motors for Traction Purposes)." Engineering Standards Committee. Report No. 72. 50 pp. 13*1*/₂ by 8 in. (London: Crosby Lockwood and Son.) 10s. 6d. net; abroad 11s.

"The Telephone and Telephone Exchanges: Their Invention and Development." By J. E. Kingsbury. 558 pp. 9*1*/₂ in. by 6 in. 170 figures. (London: Longmans, Green & Co.) 12s. 6d. net; abroad, 13s. 9d.

"Diesel Engines for Land and Marine Work." By A. P. Chalkley, with an introductory chapter by the late Dr. R. Diesel. 364 pp. 8*1*/₂ in. by 5*1*/₂ in. 181 figures. (London: Constable & Co., Ltd.) 4th edition. 8s. 6d. net; abroad, 9s. 5d.

"Mechanical World" Pocket Diary and Year Book for 1916. 330 pp. 6*1*/₂ in. by 4 in. 91 figures. (Manchester: Emmett & Co., Ltd.) 6d. net; by post, 8*1*/₂d.

"Credit, Industry, and the War." Edited by Prof. A. W. Kirkaldy, with a Preface by Prof. W. R. Scott. 268 pp. 8*1*/₂ in. by 5*1*/₂ in. (London: Sir Isaac Pitman & Sons, Ltd.) 2s. 6d. net; by post, 2s. 11d.

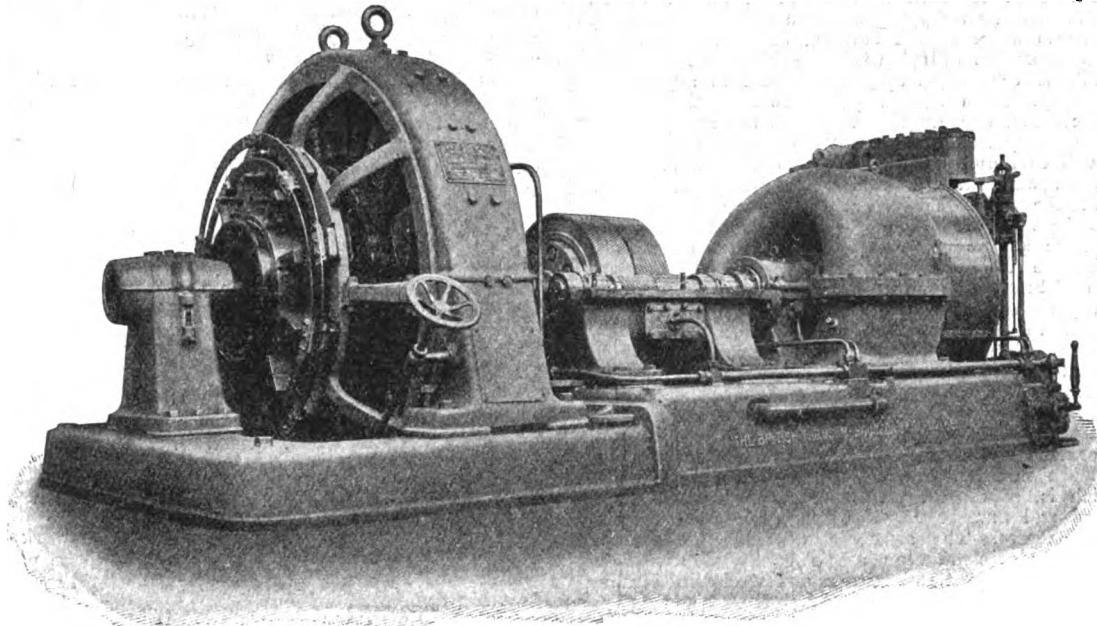
A Theatre for War Workers.—Quite the latest in the provision of recreation and relaxation for war workers is the modern and most attractive picture and variety theatre which Messrs. Vickers, Ltd., have erected in the neighbourhood of one of their very large works. From the illustrations of the interior which have been sent us, Vickers' employees are distinctly to be envied.

A GEARED D.C. TURBO-GENERATOR

CERTAIN mechanical and electrical difficulties are inseparable from the design of continuous-current machines of any considerable output running at speeds approaching that desirable for an efficient steam turbine, with the consequence that up to the present time D.C. turbo-generators have developed very slowly, and it has in some cases been found worth while to use a combination of a turbo-alternator with

siderably increases the cost and the time required to build a machine.

With recent developments in the science of gear-cutting, however, effective gearing can be produced, to reduce the high turbine speed down to that of a moderate-speed generator, and an efficiency as high as 98 per cent. has been claimed, which reduces the full-load efficiency of 93.5 per

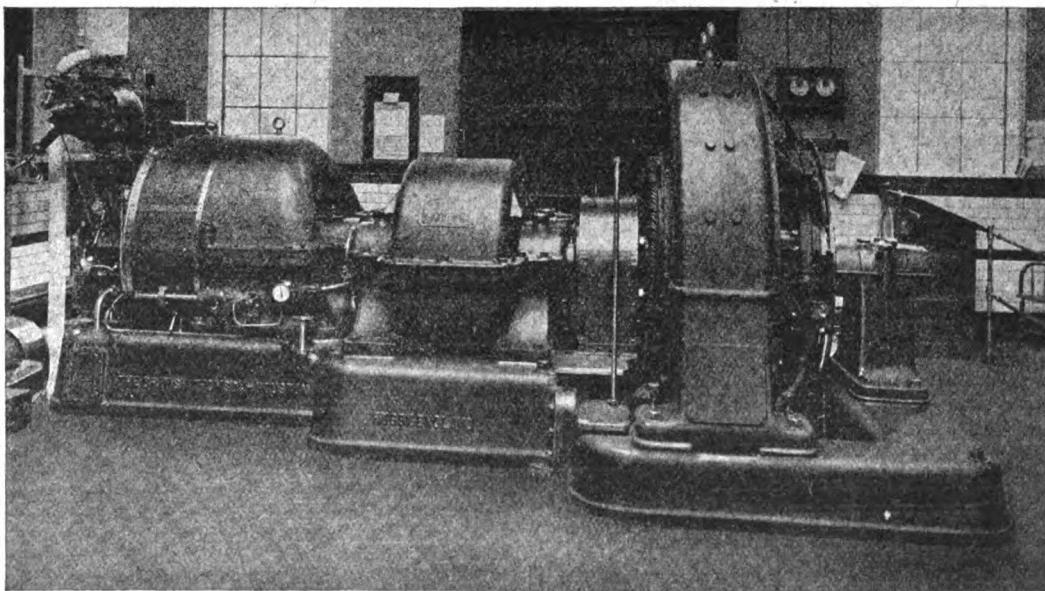


750-KW. B.T.-H. GEARED D.C. TURBINE SET.

a rotary converter, even when nothing but continuous current supply has been required. In fact, the direct-current generator is essentially a moderate-speed machine, and does not lend itself readily to construction for the high speeds of steam turbines. In building continuous-current direct-coupled turbo-generator sets, mechanical difficulties arise in the construction of the commutator, in securing the armature windings, and in arranging that the running speed shall not be near the

critical speed of a moderate-speed machine only down to 91.6 per cent. Even if the efficiency of the gearing is not quite so high as this under normal working conditions, it is obvious that the combined efficiency should be far greater than that of a turbo-alternator combined with a rotary converter.

We mentioned in our last issue (p. 496) the successful trial of a 750 kw. B.T.-H. geared D.C. turbo-generator at Nuneaton, which has resulted in an order for a duplicate set



PHOTOGRAPH OF THE SET AT NUNEATON.

critical speed. Electrical difficulties arise on account of the high reactance volts of the coils undergoing commutation and high volts per commutator segment. To ensure satisfactory operation a field structure with compensating windings is usually employed, and the consequent extra excitation losses, together with the rapid increase of core loss, friction, and windage at high speeds combine to reduce the efficiency considerably, in spite of reduced armature copper and shunt-field losses. The compensated field construction also con-

tinues to give. The practice followed by this Company as regards the dynamo itself may be outlined as follows:—

Thin laminations of special steel are used for armature core and pole-faces, to reduce the core loss, as the frequency of the armature currents before commutation will be 40 to 50 cycles per sec. Armature clamping bolts which pass through the core are insulated to reduce eddy currents. The air gap is made longer than would be the case with a slow-speed machine, so that the distortion of the main flux caused by armature reaction

is reduced. The commutating poles are so designed that over the whole working range, from no load to the guaranteed overload, the commutating flux is practically proportional to the load on the machine. The commutating-pole air-gap is adjusted on test so that the reactance volts of the coils undergoing commutation are exactly neutralised. Diverters across the commutating-pole windings are not used, as, although they form a convenient method of test adjustment, the amount of current diverted is apt to vary on account of changes of resistance due to temperature and variation of the resistance of connections, which, in the case of low-resistance windings, may form an appreciable item. Also, on varying loads, a plain diverter will not take a uniform share of the current, as its inductance is very much less than that of the winding. Inductive diverters are, in the B.T.-H. Company's opinion, difficult to adjust and are not satisfactory. Even when adjusted to operate perfectly up to heavy overloads, commutating machines are always liable to flash over on heavy short-circuits. To minimise the risk of flashing over and to reduce the damage caused by a flash, the clearance between adjacent brush brackets should be kept a maximum, and the space between the commutator and the bearing should be kept free from bus rings or earthed metal parts, as the flash always tends to spread outwards from the machine. Reference to the illustrations will show that the B.T.-H. design of brush gear fulfils these requirements. A substantial brush yoke supported from the magnet frame, brush springs designed to prevent brush chatter, and a carefully balanced armature, eliminate the mechanical causes of unsatisfactory commutation. Graphite brushes reduce the commutator loss to a minimum, and rapidly produce a hard polished skin on the commutator, the wear of which is very slight.

Equaliser rings fixed in an accessible position at the back of the armature prevent unbalanced magnetic pulls and equalise the distribution of the load between the several paths through the armature, which is, of course, parallel wound. The choice of a suitable speed and number of poles limits the volts per bar to a reasonable figure. The armature windings are secured against centrifugal force with an ample factor of safety by means of fibre wedges in the slot portion and steel wire binding bands on the ends.

The set above referred to, which was recently installed by Mr. Cameron Gibson, the Borough Electrical Engineer, in the power station of the Nuneaton Corporation, is an interesting example of a gear-driven set. It consists of a B.T.-H. shunt-wound generator having a normal output of 1,500 amps. at from 470 to 500 volts, driven through double helical gearing by a B.T.-H. Curtis turbine of 750 kw. normal capacity. The set has an overload capacity of 25 per cent. for two hours and 50 per cent. for five minutes. The complete set has been constructed by the B.T.-H. Company, and the turbine is of their standard three-stage design as used for driving alternators, and runs at 3,250 r.p.m., the gearing reducing the speed to 600 r.p.m. for the generator. The turbine drives the pinion shaft through a double claw-coupling, which allows the pinions to take their correct axial position without any end-thrust being transmitted to the turbine shaft. The armature spider is bolted direct to a large-flanged coupling on the slow-speed shaft, the bearings of which consequently carry a portion of the armature weight.

The gears and bearings are completely enclosed, and have a copious supply of oil from the main oil-pressure system of the turbine, which also operates the servo-motor of the well-known B.T.-H. governor gear. A return pipe from the bottom of the gear-case leads the oil back to the main oil tank, whence the oil-pump on the turbine delivers it through an oil-cooler back to the supply pipes.

This set was put on commercial load in January of this year, after exhaustive tests in the shops of the B.T.-H. Co. had proved that guarantees were fully met, and the completely satisfactory manner in which the set has behaved since its installation has given all concerned perfect confidence in the future of this combination, and resulted in the repeat order to which we have already alluded.

RECRUITS FOR R.E. WIRELESS SECTION

THE Wireless Section (R.E.) has vacancies for a number of electricians and instrument repairers with good practical knowledge. The need for this class of man in the wireless units is very great, and at the present time many men with the requisite qualifications, whilst wishing to enlist, may not know in what way to put their knowledge as skilled tradesmen to the best use. Enlistment for this purpose is for the period of the war only, and men would be required to enlist as sappers, but prospects of promotion for satisfactory men are very good.

Applications, stating qualifications, should be sent to the O.C., Wireless Training Centre, Worcester, from whom information regarding terms of service can be obtained.

ELECTRIC TRACTION NOTES

Two interesting Papers have recently been contributed to the Liverpool Engineering Society, entitled, "Notes on the Overhead Railway," by Mr. E. J. Neachell, and "Notes on the Mersey Railway," by Mr. Joshua Shaw. In both Papers the authors confined themselves to giving some particulars of the history of the undertakings and the working conditions and results obtained up to date.

The "Overhead" was the first elevated railway in the world to be operated electrically; its total length is 6½ miles. The permanent way consists of flat-bottomed steel rails on longitudinal sleepers. The life of the rails has been 13 years on the straight and five years on the curves, but it is expected to improve this by using better material. At the power station, which has a total annual output of 4½ million units, direct current is generated at 500 volts. Some notes are given on the automatic system of signalling, on station lighting, on rolling stock, and some interesting traffic details. A curve is also included in the Paper showing the number of passengers carried on the railway from 1893 up to last year, and it is interesting to note from this curve the effect of tramway competition, and of a temporary increase in railway fares.

In the Paper on the Mersey Railway, the notes on the power-station plant are interesting. The original plant, when this old steam railway was "electrified," consisted of three vertical cross-compound engines with generators of 1,200 kw. capacity each, and the normal method of operation was for one of these sets with a storage battery to work the periods of light traffic, and for an additional set to be put on during the peak loads. It was found, however, that the set was running lightly loaded during a great part of the day, and a mixed pressure turbine set of 800 kw. capacity was installed to take the light load. This effected a saving in steam consumption of 26 per cent. The financial results of the electrification appear to have been very satisfactory. A comparison of 1902, the last year of steam working, with 1913, shows a net annual increase of revenue of £37,000, after allowing for the interest on the additional capital, which had to be provided for electrification purposes.

Magnetic Testing.—A very useful historical review of the various methods of testing magnetic materials is given by Messrs. A. Campbell and D. W. Dye, of the National Physical Laboratory, in a Paper communicated to the I.E.E. and published in the *Journal*. This summary of methods used in the past affords to the practical experimenter a variety from which he can choose what is most suitable for his samples and equipment of instruments. The essential feature of the methods given is that the value of H, the magnetising force, is not calculated from the indefinite length of the magnetic circuit and the ampere turns, but is directly measured by the aid of a special form of search coil placed as near as possible to the surface of the iron, through which passes the flux in the air, but not the iron.

Tax on Electricity in Russia.—It is reported that the following taxes on electricity supply in Russia have been proposed: 4 kopecs per kw.-hour for current used for private lighting, theatres, shops, warehouses, &c.; 2 kopecs per kw.-hour for current used for lighting factories, &c.; 1 kopec per kw.-hour for current used for lighting streets and stations on private railways; and ½ kopec per kw.-hour for current used for heating and power. A kopec is about a ¼d.

The Royal Institution.—Among the lecture arrangements after Christmas are a course of six illustrated lectures adapted to a juvenile audience on "Wireless Messages from the Stars," by Prof. H. H. Turner, and three lectures on "The Utilisation of Energy from Coal," by Prof. W. A. Bone. The Friday evening meetings will commence on January 21st, and discourses will be given during the session by, among others, Prof. Silvanus P. Thompson, F.R.S., and Prof. Sir J. J. Thomson, F.R.S.

Artists Rifles O.T.C.—The Officer Commanding the 2nd Battalion of the Artists Rifles (Officers' Training Corps) has decided to form a special company to consist mainly of professional men whose technical experience renders them qualified for appointments as officers to those units or branches of the Army in which knowledge of construction and engineering is especially useful in the conditions obtaining in modern warfare. Applications for nomination to the Corps should be made to the Headquarters, 7 Duke's Road, Euston Road, W.C.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,473.

In a 3-wire A.C. 1-phase network (200 volts across outers) and the neutral not earthed, at normal times the pressure obtained from each of the outers to earth is 100 volts; the neutral, although unearthed, is at earth potential. When one of the outers develops a high resistance earth, the pressure from the unearthed pole to earth becomes 180 volts, from the earthed pole to earth 40 volts, and from the neutral to earth 50 volts. At the same time the normal pressure is obtained across the conductors. Why is this?

"SULPHUR."

(Replies must be received not later than first post,
Thursday, Dec. 23rd.)

ANSWERS TO No. 1,471.

I have about twelve motors, varying in size from 30 to 200 h.p., running on a 25-cycle, 3,000-volt system, all driving haulage gears. I propose to double this number of motors, at least, and to add motors up to about 500 h.p. for driving heavy haulages, air compressors, &c. Would it be efficient and worth the extra capital outlay for more flexible running and standardisation, &c., to change my system, to, say, 40 or 50 frequency? In order to do this I have to add considerably to my power-station units. In this case I should have to scrap the above 25-cycle system or instal some method for running 25-cycle motors from a new system of 40 or 60 cycles, assuming that my existing 25-cycle generators require absolutely renewing. What is the best arrangement for running 25-cycle motors from a 40-cycle system? And what are the principal factors to take into consideration for embarking upon such a scheme?

"REPRESENTATIVE."

The first award (10s.) is given to "W. H." for the following reply:—

The question put forward is one which can only rightly be answered by a consulting engineer after a prolonged investigation of the conditions. For instance, it would be necessary to take into account the capital expenditure required, as this would be a considerable amount; also as to whether the greater adaptability of the 40- or 50-cycle system would justify the greatly increased expenditure.

If it were decided to retain the 25-cycle supply the changes to the plant would only consist of the addition of new motors and corresponding generating plant. The points in favour of this scheme are the low initial cost and simplicity attained by having only one supply system installed.

The point raised by your correspondent regarding flexibility, although applying where high-speed motors are concerned, has little effect in a plant of this description. The reason for this statement is that motors for haulages and compressor drives are almost invariably slow-speed machines, thus having a fairly large number of poles even on 25-cycle circuits. It will be obvious, therefore, that speeds can be selected for the motors to suit most drives.

Again, the initial cost of the 25-cycle motors will be practically the same as that of 50-cycle motors in the case of these slow-speed machines. Also the 3,000-volt, 25-cycle generat-

ing plant would cost very little more than 50-cycle, 3,000-volt generating plant of the same capacity.

Regarding standardisation, I would suggest that no manufacturer in this country stocks motors, or wound portions thereof, suitable for 3,000 volts, 50 cycles, and therefore replacements and repairs would take an equal time for either 25-cycle or 50-cycle. It is assumed that transformers will not be used except possibly for the smallest sizes of motors.

The arguments given will show that for average circumstances it would be advisable to retain the 25-cycle supply system. If, however, special circumstances allow of scrapping the plant, I should strongly advise a 50-cycle system and a complete change over, so as to avoid having a dual supply.

If this is too drastic a procedure, it will be necessary to instal a frequency changer. This would preferably consist of a synchronous 50-cycle motor coupled to a 25-cycle generator. The speed would be approximately 500 r.p.m., thus making 12 poles on the motor and 6 poles on the generator, and at the same time allowing a reasonable speed for an exciter of sufficient capacity for both motor and alternator fields.

If the motor speeds are not very important, an induction motor could be used in place of the synchronous motor, but the supply from the generator would then be about 24½ cycles at full load. The cost of such a set of, say, 500 kw. capacity with switchgear would be in the neighbourhood of £1,800, and the synchronous set would be a little more expensive and slightly less efficient, but would have a better power factor on the motor side.

The second award (5s.) is given to "E. H." for the following reply:—

It is difficult to know why "Representative" wishes to alter the frequency of his system from 25 to 40 or 50. The main drawback of 25 cycles is the flickering of the light given off by arc lamps when working at that frequency. With filament lamps, however, this flickering is almost imperceptible.

In the case in question, it appears that the bulk of the power is absorbed by motors; consequently, it is the effect of frequency upon the working of the motors that demands most attention. Now, the higher the frequency, the greater are the number of poles required to give a certain speed; thus, a 1,450 r.p.m. induction motor must be wound for 4 poles when running off 50 cycles, but 2 poles give the same speed at 25 cycles. But increasing the number of poles on a motor decreases both its power-factor and its overload capacity, other factors being kept constant. Again, the efficiency of a 50-cycle system is, if anything, lower than that operating at 25 cycles, due to the greater iron losses in the machine, and to the slightly larger current required for a given power.

If "Representative" decides to instal 40 or 60-cycle plant, the present alternators might be used as the generators of the synchronous motor-alternator sets for supplying the 25-cycle motors, this being the simplest method of converting the frequency.

The principal factors to be taken into consideration in the above question are:—(1) The relative importance of the arc-lamp lighting and the power load. This is a matter of judgment, and cannot be expressed in £ s. d. (2) The relative costs of the new plant. The cost of replacing the present generators, and of the motor-alternators must be included in the estimate for the higher frequency. (3) The efficiency of the systems, the effect of the power-factor being taken into account.

It appears to the writer that in the case under consideration the best thing is to continue and extend the system with the 25 cycles. There are a number of supply companies working quite satisfactorily at this frequency.

The Commercial Motor Vehicle Parade.—The Tenth Annual Inspection of Commercial Motor Vehicles organised by the Commercial Motor Users' Association, will take place in May, 1916. Entries should be sent to the Secretary, 83 Pall Mall, S.W., not later than January 15th. There will be oral and written examinations for drivers of electric vehicles, and the Electric Vehicle Committee of the I.M.E.A. is presenting a number of prizes.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 9th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

22,437/14. "Arc Incandescent" Lamp. E. A. GIMMINGHAM. A lamp of the same size and shape as an ordinary incandescent lamp, in which an arc is produced between tungsten electrodes in an inert gas. A heater is provided for ionising the gas. One electrode is in parallel with one end of the heater, and the other electrode is formed by the ioniser or by a shield thereon. The current is automatically cut off from the heater a short time after starting. A small quantity of barium chloride is provided in the bulb, which at the working temperature gives off a minute quantity of oxygen for facilitating the initiation of the arc. (Seven figures.)

22,931/14. Condensers. GALVANOPHOREN-WERKE (SYSTEM VOGT), S. SZUBERT, KOMMANDITGESELLSCHAFT & VEREINIGTE ELEKTRICITÄTSWERKE GES. A method of manufacturing air condensers in which the sets of plates are cast under pressure in one piece, together with the intermediate portions for the distance of the plates. (Three figures.)

23,676/14. Heating Elements. F. S. GROGAN. An improved heating element for hot plates, grills, &c., consisting of a grid of resistance coils constructed of flat metal tape coiled into a helix of small diameter, with the convolutions separated from one another, and without further insulation between them or other support. The convolutions near the centre of the frame are further apart than at the edges to equalise the temperature. (Six figures.)

3,502/15. Induction Motors. B.T.-H. Co. (G.E. Co., U.S.A.). Rotor for induction motors in which the conductors, end rings, and spider are formed of a single piece of aluminium cast on to the laminations. (Two figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: OATES [Cable conduits] 2,883/15; UREN and GAMBLE [Conduit joints] 8,458/15.

DYNAMOS, MOTORS, AND TRANSFORMERS: A.E.G. [Cooling of turbo-generators] 22,950/14.

Electrometallurgy and Electrochemistry: BASSANESE [Tilting electric furnace] 1,173/14.

Heating and Cooking: MAJESTIC ELECTRIC DEVELOPMENT CO. [Radiator] 1,740/15; JACKSON ELECTRIC STOVE CO., GRIESBACH, HOLMES, SMITH, and WILLIAMS [Cooking] 9,158/15.

Ignition: STRETT [Sparkling plug taster] 24,589/14; SIMPSON [Contact breakers for magnetos] 5,673/15.

Incandescent Lamps: TERRY [Incandescent lamps] 23,113/14; W. SANDERS & CO. and SANDERS [Incandescent lamps] 1,715/15.

Instruments and Meters: LANDIS AND GYR, S.A. [Prepayment meters] 20,146/14.

Switchgear, Fuses, and Fittings: SIEMENS & HALSKE A.G. [Remote control apparatus] 22,297/15; ELECTRIC & ORDNANCE ACCESSORIES CO. and ETCHELLS [Switches] 23,321/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Switches and circuit-breakers] 2,386/15; GILES [Switches] 5,943/15.

Traction: SAMUEL, SLINGO, GUNTON, and DOUGLAS [Railway system] 10,951/15; SAMUEL, SLINGO, GUNTON, POWELL, and KINGSTON [Railway system] 10,958/15.

Miscellaneous: B.T.-H. CO. and WHEAT [Illumination of surfaces] 23,072/14; B.T.-H. CO. (G.E. CO., U.S.A.) [Vapour electric devices] 23,122/14; H. W. COX & CO. and DONNITHORNE [X-ray apparatus] 23,236/14; R. BOSCH [Regulators] 1,609/15; BOBROFF and UNIVERSAL INDICATOR CO. [Signalling apparatus] 5,629/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, &c.: GIRARDEAU [DYNAMOS] 16,107/15.

Telephony: RELAY AUTOMATIC TELEPHONE CO., LTD. [Automatic telephone systems] 12,673/15.

The following are the more important Patents that have become void through non-payment of renewal fees.

Electrochemistry and Electrometallurgy: F. J. CLARKE [Electrolysis] 17,152/05.

Storage Batteries: A. J. BOULT (Allgemeine Akkumulatoren-fabrik) [Battery plates] 17,750/08.

Switchgear, Fuses and Fittings: VERITY'S, LTD., and A. E. GOTTR [Rheostats] 17,146/05; W. A. G. HILL [Shade holders] 17,706/08.

Traction: J. W. MACKENZIE (U.S. Motor Vehicle Co.) [Electric heavy chassis with four wheel drive] 18,975/06.

the same time naturally felt that the established system was the safer one to use.

I should like to say that at all times Mr. Parker looked at the different problems in the broadest possible way, and his whole attitude was characterised by absolute fairness, and was not aggressively partisan, a characteristic that has not been particularly marked in those advocating the high-tension overhead alternating-current traction systems.

My mind turns back on this arbitration with particular pleasure on account of the association with the Hon. Alfred Lyttelton, who, while he viewed the whole problem very largely from a legal point of view, decided broadly, on the basis of the three-phase system being experimental, that the Metropolitan Company had no right to adopt a system which would impose an experiment on the District Railway.

Both of these gentlemen have now passed from us, and although the system of which I was a special advocate for the purposes of the Underground Railway was approved, there remains the pleasantest memory as regards the fairness and the broad-minded way in which the whole of the numerous arguments advanced were dealt with.

I met Mr. Parker a great many years ago at his works at Wolverhampton, and the opinion I then formed of him was always retained, viz., that he was an engineer graced with the most broad and kindly instincts.

Yours truly,

H. F. PARSHALL.

Salisbury House,
London Wall, E.C., Dec. 10th.

AN ATTRACTIVE "WOTAN" SIGN

WE illustrate one of the new "Wotan" showcards which Messrs. Siemens Bros. Dynamo Works, Ltd. (39 Upper Thames Street, E.C.), are now issuing for trade display. This showcard is a collapsible box arrangement having a black



velvet background, against which the cut-out of the "Wotan" lamp is silhouetted. It is of handy size (11 in. by 7½ in.), and is reproduced in effective colours. It can be used for counter, desk, or window display, and will be supplied to customers on receipt of inquiry.

CATALOGUES, PAMPHLETS, &c., RECEIVED

MILITARY TELEPHONES.—A number of patterns of field and rifle-range telephones are included in a well-printed list sent us by James McMillan & Co. (Clun House, Surrey Street, W.C.).

CALENDAR.—An exceptionally well got up and printed almanac for 1916 has been sent us by Messrs. Abdulla & Co., the cigarette specialists, 168 New Bond-street, London, W. It contains reproductions of drawings and paintings by a large number of well-known artists, and three of the pictures were exhibited this year at the Royal Academy; 20,000 copies of this almanac have been given for sale for the benefit of the funds of the British Red Cross Society, and it is hoped that at least £1,000 will be realized.

Arrangements for the Week.—(To-day) Thurs., Dec. 16th. Institution of Electrical Engineers. "The Design of High-pressure Distribution Systems," by J. R. Beard. 8 p.m.

Fri., Dec. 17th. Electro-Harmonic Society. Holborn Restaurant. Smoking Concert.

Institution of Mechanical Engineers, at Institution of Civil Engineers. "Engineering Colleges and the War," by Dr. R. Mullineux Walmsley and C. E. Larard. 6 p.m.

Mon., Dec. 20th. Junior Institution of Engineers, at I.E.E., Victoria Embankment. "Modernisation of Power Plant in Factories," by W. A. Tookey. 7.30 p.m.

German Electrical Standards in Portugal.—H.M. Minister at Lisbon reports, says the *Board of Trade Journal*, that in almost all matters concerning electrical installations, fittings and material in Portugal, and in the rules and instructions governing such installations, the Portuguese Government have adopted the regulations of the "Verband Deutscher Elektrotechniker," and this has had the effect of putting the electrical engineering trade largely in German hands. The stoppage of electrical supplies from Germany, however, since the war commenced, is causing serious difficulties to the electrical trade in Portugal, and as a result of H.M. Minister drawing the attention of the Portuguese Government to the matter, it has been decided to include British standards within the Portuguese law. It is hoped that this concession will facilitate the export of British electrical material to Portugal.

Fire at Ediswan Works, Ponders End.—Owing to the fact that erroneous reports have been circulated that the fire at the Ponders End Works of the Ediswan Co. was very serious, we state the true facts:—On Saturday, the 11th inst., a fire broke out in the joiners' shop, which is an extensive building of two floors, employing nearly ninety hands. Fortunately the fire did not spread, and was confined entirely to that department. The "self-contained" nature of the Ediswan works, however, enabled things to be set going on Monday morning when work was resumed.

INDUSTRIAL ELECTRIC HEATING

THE use of electricity for heating dwellings, shops, show-rooms, &c., has made vast strides forward during the last year or two, and now that the necessity to practise economy in all establishments, including factories, workshops, and offices, is being felt, electricity is taking its proper place as the heating medium. Besides the growing use of electric heating in new factories, workshops, and offices, cases are on record where a change-over has been made, from steam to electric heating, as it has been found to be pleasanter and more hygienic. One of those go-ahead firms which has carefully gone into the question of steam, hot-air, electric and other forms of



"MAGNET" ELECTRIC FIRE INSTALLATION.

heating for offices is Messrs. Edward Cook & Co., Ltd. (East London Soap Works, Bow). This firm thoroughly tested steam heating throughout its new offices, and finally decided to replace it by an electric heating system on the "Magnet" panel type electric fires. Thirty 1·5-kw. and twenty 2-kw. "Magnet" fires have been installed throughout the various offices, telephone operating room, typewriting and post departments, &c. The illustration above shows some of the "Magnet" electric fires in the general office. "Magnet" fires, of course, are made by The General Electric Co., Ltd., at its Birmingham works.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Aberdeen.—The extension scheme estimated to cost £21,000, referred to in our last issue as having been adopted by the Electricity Committee, was discussed at some length at the Council meeting last week. Eventually it was defeated by 17 votes to 14, notwithstanding the statement of the City Electrical Engineer that he could not undertake to maintain the full supply with the present plant. The rejection of the scheme is understood to be for twelve months.

Burton-on-Trent.—Application is to be made for a loan of £3,500 for mains extensions. It is stated that some of the existing mains are already over-loaded, and that the extensions are necessary in order to deal with new consumers waiting to be connected.

London: Hackney.—An estimate of £3,000 has been approved in connection with the linking up with Poplar.

Monaghan (Ireland).—A meeting of the ratepayers is to be called to decide whether permission shall be given to a company to carry out an electric lighting scheme by means of overhead wires. One of the points of controversy appears to be that the new company proposes to buy out the existing gas company.

Nuneaton.—The L.G.B., writing with regard to an application for a loan of £10,000 for extensions to the power-house, states that having given the matter further consideration, no exception is taken to the Council entering into definite contracts for the plant.

Redditch.—A loan of £12,542 is in contemplation in connection with extensions at the power-house.

Miscellaneous

Australia.—The Sydney Corporation requires two electrically-driven centrifugal pumps, each capable of pumping 4,000 gallons per minute, together with the necessary starters, spare

parts, &c. Tenders to the Metropolitan Board of Water Supply, 341 Pitt Street, Sydney, by February 7th.

The above notice is only of use to firms who can cable agents.

Colombia.—In a list of goods in demand at Bogotá, hitherto supplied by German firms, H.M. Minister in that city writes that electric light fittings and shades should be included.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Gillingham.—The Council is to purchase three Edison electric vehicles, at a cost of £8,500. The contractors, Messrs. A. H. Johnson & Co., Ltd., are to be asked to accept six half-yearly payments, plus interest on the unpaid amount at 5 per cent. per annum.

Pembroke (Ireland).—Subject to the L.G.B. sanction, a Diesel engine is to be purchased from Messrs. Sulzer Bros. The Borough Electrical Engineer has intimated that he cannot carry on the work of the Department without a new engine.

Southampton.—The tender of the British Insulated & Helsby Cables, Ltd., for 450 yards of 1-inch high-tension concentric lead-covered paper-insulated cable and 800 yards of 0·25 sq. inch cable, have been accepted at £121 10s. and £90 18s. respectively.

LOCAL NOTES

Glasgow: Cookery Demonstration.—Mr. W. W. Lackie, the Corporation Electrical Engineer and Manager, has sent us a copy of a folder and invitation to Cookery Demonstrations in the Corporation's showrooms. These are being sent out to consumers, and a specimen menu is appended to the invitation.

Hove: Change from 110 to 220 Volts.—The Lighting Committee reports that there are two consumers who refuse to be changed over from 110 to 220 volts. In consequence of the extra expense of supplying these two consumers at the lower voltage, the Board of Trade is to be appealed to in the matter.

Hythe: Cost of Public Lighting.—The cost of public electric lighting under normal lighting conditions is £850 per annum, but an agreement has been come to with the Folkestone Electric Supply Co. for the charge to be reduced to £425 whilst all public lamps are extinguished. In the event of re-lighting being permitted, the charge will be increased *pro rata* according to the number of lamps.

Luton: Failure of Supply.—The failure of the supply of electricity in Luton for a short time on Thursday last week was due to a curious, but nevertheless interesting cause. It appears that at 9 o'clock in the morning the whole of the fitting staff, who are starved men, went to the recruiting office for the purpose of being attested under Lord Derby's scheme. Whilst they were away, one of the mechanical stokers went wrong, and put a boiler out of action. Although there was another boiler practically ready for use, a certain amount of work had to be done upon this, and there was nothing for it but to fetch the men, still unattested, back from the attesting station, with all speed. This was done, and the supply was quickly resumed.

Manchester: A New Power Customer.—During the course of an inspection of the Corporation's power stations last week by the members of the Electricity Committee, it was stated that the British Carbide Co. is transferring its works from Norway to the vicinity of Stuart Street, owing to the advantage of the cheap supply of electric power which is available there.

Newquay: Proposed Increase in Charges.—A short time ago we reported that opposition was being offered to the proposal of the Newquay Electric Supply Co. to increase the maximum charge under its Provisional Order from 6d. to 8d. A local inquiry was held last week on behalf of the Board of Trade, when it was stated that the Company was actually under the impression that 8d. was in the original Order until the agreement with the Council came to be negotiated. At the conclusion of the inquiry the inspector expressed the opinion that the Company had not made out an overwhelming case, but they had made out something of a case for consideration owing to war conditions. Eventually an agreement was

arrived at with the Council for the maximum price to be increased to 7d. until after the expiration of one year after the conclusion of peace.

Peterborough: Coal Prices.—The Town Clerk has been in correspondence with the coal contractors to the Electricity Department as to the amount of the abatement to which the Corporation is entitled under the Coal Supply (Limitation) Act, 1915. Negotiations are still proceeding, and the Acting Borough Electrical Engineer is communicating with other municipal electrical engineers on the point.

Wednesbury: Difficulties of Supply.—The Electricity Department have been experiencing a little difficulty in maintaining full supply to all consumers, but it is anticipated that the delivery of a new rotary converter will remedy matters to a large extent. The new machine was ordered in June last for delivery in October, but, as in many other places, there have been serious delays, for obvious reasons.

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £97 to £98 (last week, £97 10s. to £98 10s.).

Liquidation.—The Renew Electric Lamp Co., Ltd., is to be wound up voluntarily. Mr. J. E. Percival, 6 Old Jewry, E.C., is liquidator, at whose address a meeting of creditors will be held to-morrow (Friday).

New Address.—As will be seen from our advertisement columns, the Electrical Supplies Co., Ltd., has now moved into the Light House, 233 Tottenham Court Road, London, W.C. The telephone numbers are Museum 2516 and 2517, and the telegraphic address Elecsplico, Ox-London.

APPOINTMENTS AND PERSONAL NOTES

We owe Mr. H. E. Yerbury, Deputy General Manager and Engineer to the Sheffield Corporation Electric Supply Department, an apology for a slight inaccuracy on page 496 of our last issue. We referred to him as the "Assistant Engineer," and at the same time a slip in the spelling of his name escaped notice.

The B.E.A.M.A. has made a second donation of £200, making a total of £1,000, to the *Times* Fund for the Sick and Wounded, on behalf of the British Red Cross Society.

Mr. C. E. Garnett, Borough Electrical Engineer, Darwen, has enlisted under the group system.

Mr. C. W. Salt, Borough Electrical Engineer, Torquay, has been granted leave of absence to join the Forces. The Assistant Electrical Engineer will carry out the duties meanwhile. Already 24 members of the Department have joined, and there are only five eligible men left, regarding whom an appeal is to be made on the ground that they are indispensable.

Charge Engineers are wanted for tramway sub-stations. (See an advertisement on another page.)

Lanarkshire Tramways Co. want a Shift Engineer. (See an advertisement on another page.)

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.—There was a net profit of £80,404 for the year ending Sept. 30th. The final dividend, making 10 per cent. for the year, is declared on the ordinary shares. The general position of the Company is extremely satisfactory.

British Electric Traction Co.—The capital re-organisation scheme referred to in our columns on several occasions was sanctioned by Mr. Justice Astbury in the Chancery Division last week. There was some opposition by a minority of the Income Certificate holders, who were, however, allowed their costs.

Newcastle-on-Tyne Electric Supply Co.—The interim dividend of 2½ per cent. on the ordinary shares postponed in July, is now to be paid.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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THURSDAY, DECEMBER 23, 1915.

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Rates for Small Prepaid and Official Advertisements, see pp. iv and v.

Other Advertisement Rates on Application.

Latest Time for Receiving

Letters for Insertion, Tuesday first post.

Small Advertisements and Official Announcements, Wednesday first post.

Displayed Advertisements, Tuesday first post.

Corrections in Standing Advertisements, Monday first post.

All letters to be addressed to "Electrical Engineering," at the EDITORIAL AND PUBLISHING OFFICES: 203-206, TEMPLE CHAMBERS, LONDON, E.C.

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CHEQUES to be made payable to THE KILOWATT PUBLISHING CO., LTD., and to be crossed LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

WE give the reasons why the Court of Appeal has upheld the judgment of Mr. Justice Joyce that the process of metal filament lamp manufacture used by Pope's Electric Lamp Co., Ltd., does not infringe the Just & Hanaman patent No. 23,899 of 1904 (p. 506).

IN the course of an interesting discussion at the Illuminating Engineering Society last week the new arc-incandescent lamp which is being developed by the Edison & Swan Co. was exhibited and demonstrated. Mr. F. W. Willcox, of the British Thomson-Houston Co., differed from Professor J. T. Morris as to the advantages of the horizontal spiralled filament lamp unless advantages can be shown in higher efficiency, as in the case of the half-watt lamp (p. 506).

THE electrification has now been completed of a section of the main line of the Pennsylvania Railroad at Philadelphia. The equipment is single phase with repulsion starting series motors (p. 507).

AN interesting and important action is pending in which the question of the validity of contracts for electric power supply entered into before the war is raised. The West Bromwich Corporation has threatened, owing to the extra cost of fuel since the war, to increase by 20 per cent. the charges agreed to with a power consumer in 1912 (p. 507).

AMONG the subjects of specifications published by the Patent Office last Thursday are renewable incandescent lamps, circuit-breakers, H.-T. switches, conduit joints, and self-contained cooking utensils without flexible leads. Applications for suspension of seven enemy patents relating to Thermit rail welding will be heard tomorrow. Patents having reference to magnetic blow-out controllers and varnished fabric insulation of cables expire this week after a full life of fourteen years (p. 508).

OUR Questions and Answers columns this week deal

with the cause of the momentary large rise of current which sometimes happens on switching a transformer into circuit (p. 508).

WE describe new electric heaters, &c., and also half-watt lamp fittings (p. 510).

WE illustrate the first form of the new tungsten arc lamp which is being developed by the Edison & Swan Co., Ltd. This is for projector lanterns (p. 511).

WE describe a rough test of a new dry cell which was practically unaffected by long periods of short-circuit (p. 511).

MAINS and services are required at Marylebone (£3,800), and Kingston-on-Thames (£3,307). A considerable expenditure is in prospect upon electric lighting and tramways in New Zealand (p. 512).

CONSIDERABLE additions are to be made to the electricity charges at Brighton.—Difficulties which are being experienced with coal supply at Manchester were mentioned in the House of Commons last week (p. 512).

THE London Electrical Engineers R.E. (T.F.) is again open for recruiting (p. 512).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Thurs., Dec. 23rd, to Thurs., Dec. 30th, inclusive.—Headquarters closed.

Fri., Dec. 31st.—Social evening, 6.15 to 8.15.

Sat., Jan. 1st: Uniform parade.

Officer of the Week: Monday, December 20th, to Saturday, January 1st, Mr. Corbett.

Platoon on Duty: Monday, December 20th, to Saturday, January 1st. No. 2 Platoon.

Power Tariffs in Berlin.—Changes are being made in the conditions and rates for power supply by the Berlin Elektricitäts Werke. The fee formerly payable for connection will not be required, nor the fee for testing the installation before connecting. The most important alteration is a revision of the rates for industrial power supplied from the H.T. mains. In the past the usual contract was made on the basis of a ten years' agreement with a minimum annual consumption of 200,000 units, the charge being based on the consumer's average load factor during the year, expressed as the "Benutzungsdauer" (the equivalent number of hours consumption at maximum demand), obtained by dividing the total consumption in kw. hours by the maximum demand in kw. between 4 p.m. and 7 p.m. in the winter months. This calculation has always been a source of misunderstanding and dispute, and is to be avoided by the adoption of the system now so much favoured in this country and known as the "telephone system." A fixed charge of from 10 to 7 marks per month per kw. of maximum demand plus three pfennigs per unit will be charged (approximately £6 to £4 4s. per kw. per annum of maximum demand plus 0.36d. per unit), the amount of the fixed charge per kw. depending upon the extent of the consumer's demand. The maximum demand will be determined by a maximum-demand meter as before.

THE OSRAM v. POPE PATENT ACTION

Chancery Judgment Confirmed

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The patent which the Osram Lamp Works had alleged was infringed was that of Just & Hanaman, No. 23,899 of 1904, and the material parts for the purpose of the action are as follows:—

For the manufacture of filaments of this kind finely divided tungsten or tungsten compounds such as tungstite, tungstic acid, or tungstic sulphide are mixed with an organic binding medium, such as collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide or the like, from which mass filaments are formed in the usual manner, and are then carbonised, in some instances after denitration has previously been effected. The filaments so produced and consisting of tungsten and carbon are then submitted to the following further treatment.

First of all the carbon, which has only served as a binding medium, is removed by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen, and thus raising it to a high temperature. By this process the carbon is completely oxidised so as to form carbonic oxide and a filament of tungsten is left. These filaments are then rendered uniform in a manner similar to that employed in the treatment of the usual carbon filaments, by submitting them to the action of current in an atmosphere of volatile tungsten compounds in the presence of a large quantity of hydrogen whereby the tungsten deposited equalises the filaments. The filaments which have been rendered uniform in this way are then sealed in glass bulbs in the usual manner, and these latter are exhausted.

Mr. Justice Joyce held that the Pope Co. do not use any of the processes of carbonisation set out in the patent, nor do they use an atmosphere of steam and hydrogen in the sense in which the phrase was used in the specification or was intended by the patentees. Indeed, he did not think the defendants used steam at all in the ordinary sense.

Lord Justice Banks, in his judgment, detailed the steps followed in the Pope Co.'s process as set out during the proceedings before Mr. Justice Joyce, and then pointed out the main points on which the two processes differ. In the first place, he said, the Just-Hanaman process involved the use of a soft material, whereas in the Pope process a hard material was used. In the second place, carbonisation under the patent was done separately and before any attempt was made to decarbonise, whereas in the Pope process carbonisation and practically the whole of the decarbonisation are done at one and the same time in the first furnace or in the vacuum, as the case may be. In the third place, the heat necessary for the decarbonising part of the process as described in the patent was produced by passing an electric current through the filaments, whereas the Pope Co. applied the heat externally. In the fourth place, under the patent the filaments were exposed to a previously prepared atmosphere of steam and hydrogen, which was not the case in the Pope process. In some respects the differences might be differences of degree rather than of kind, but, having considered the question whether the defendants' process as a whole, and having regard particularly to the four points indicated above, was substantially the same as the process set out in the patent, he was of the opinion that it was not. In his view, the differences passed the border line which separates a difference in degree from a difference in kind, and the process as a whole was, in his opinion, substantially different from the one described in the patent. Therefore the appeal failed, and would be dismissed with costs.

Lord Justice Warrington, who concurred, said that the process used by the Pope Co. started from a different standpoint to that of the patent. The several steps in it were different in nature and had different aims and results, and the variations in it, as compared with the patent, were not merely colourable alterations.

At the conclusion of the reading of the judgments Mr. A. J. Walter, K.C., for the Osram Co., said he presumed the Court would not grant a stay.

Lord Justice Bankes: No.

RECENT DEVELOPMENTS IN INCANDESCENT LAMPS

AT the Illuminating Engineers' Society on Tuesday last week a discussion took place upon recent developments in electric incandescent lamps in relation to illuminating engineering. Professor Silvanus P. Thompson, F.R.S., was in the Chair.

Dr. J. T. Morris opened the discussion, and after tracing the history of the electric incandescent lamp from the earliest Swan lamp, dealt at some length with the tendency to adopt horizontal spiral filaments instead of the vertical hair-pin type. One advantage of these, he said, is that the light can be controlled more easily, although his experience had been that the life is something like 20 per cent. shorter. This, however, he did not regard as serious, because the cost of current in a lighting installation was very much larger than the cost of lamps, and even with a life of only 200 or 300 hours the total running cost of an installation might be less than with the older type of filament on account of the greater efficiency of the spiral filament. Professor Morris described the new arc-incandescent lamp which is now being developed by the Ediswan Co.; this was described in our issue of Dec. 9th, and is further illustrated this week. In this connection tests of the relation of candle-power to voltage which Professor Morris has carried out are interesting. Whereas with the carbon filament lamp a 1 per cent. change in voltage usually means a 6 per cent. change in candle-power, with the new arc-incandescent lamp the change of candle-power with 1 per cent. variation in voltage is only $\frac{1}{4}$ per cent. Finally Professor Morris made a suggestion that with these new forms of spiralled filament lamps a polar curve should be given on the wrappings they are sold in, so that the purchaser would have a good idea of what the candle-power was supposed to be in particular directions.

Following Professor Morris's remarks, Mr. S. R. Mullard exhibited and demonstrated the new arc-incandescent lamp of the Edison & Swan Co., and pointed out that they have been made in the laboratories up to 1,200 candle-power, both electrodes being of tungsten.

Mr. F. W. Willcox (British Thomson-Houston Co.) discussed in some detail the change in design and character of fittings necessitated by the introduction of the half-watt lamp in particular, and spiralled filament lamps in general, but did not share Professor Morris's view that this type of filament would necessarily replace the vertical filament. This could only be, he said, if there was greater efficiency, as in the case of the half-watt lamp. Being a much shorter filament, the spiral was bound to be much hotter, and consequently the life shorter.

Several other speakers took part in the discussion, including Mr. W. R. Cooper, who asked for further details of the arc-incandescent lamp; Mr. A. E. Cunningham, of the London & South-Western Railway Co., who raised the question of the necessity for standardising the expression of the candle-power of these new forms of lamps, and also discussed the advantages of under-running half-watt lamps; Mr. E. Stroud, of the Holophane Company, who disagreed with Mr. Willcox that it is necessary to have special reflectors for half-watt and horizontal filament lamps, although he agreed that greater care is necessary in adjusting the position of the lamp in the reflector in order to get the illumination in any desired direction; and Mr. L. Gaster, who urged manufacturers not to push these new forms of lamps until they are absolutely satisfactory from every point of view.

In winding up the discussion, Professor Silvanus Thompson twitted manufacturers in connection with the high prices now charged for incandescent lamps, which, he said, he was quite certain was very much higher than they need be.

The Institution and Enemy Members.—The Journal of the Institution of Electrical Engineers for December 15th states that representations have been made to the Council by certain members to the effect that members of enemy origin and nationality should be excluded from membership. It is pointed out, however, that the Council is legally advised that the only powers of expulsion which the Institution or its Council appears to have are those contained in Article 41 of the Articles of Association. May we remind the Council, however, that there is nothing to prevent, if it is thought advisable, the Articles of Association being revised at a special general meeting of the members? A letter on this subject appeared on p. 492 of our issue for December 9th.

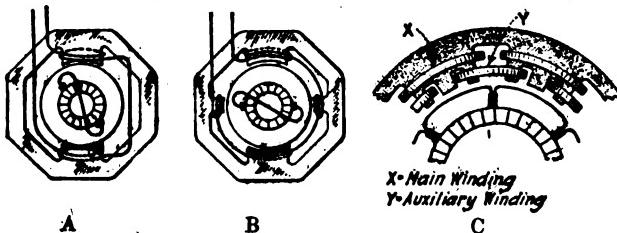
The B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.: Cole, Marchant & Morley; Hick, Hargreaves & Co.; The Edison & Swan United Electric Light Co.

THE REPULSION-STARTING TRACTION MOTOR

THE adoption of single-phase power supply with repulsion-starting series motors, for the electrification of the suburban line of the Pennsylvania Railroad at Philadelphia, marks a new step in the progress of electric traction. The electrified section of this railway, which is described at length in the *Electric Railway Journal*, is about 20 miles long, and the rolling-stock consists of 93 all-steel cars, all equipped as motor cars.

Each car is provided with two 225-h.p. Westinghouse single-phase, air-blast-cooled motors, mounted on one truck. All the main electrical apparatus is placed at one end of the car, and the brake equipment at the other, giving about 60 per cent. of the total car weight on the driving wheels. The motors are connected in series, and are started and operated up to 15 miles per hour as repulsion motors, with the compensating field, the armature, and the main field in series. With these series connections the armature is short-circuited through resistance. Resistance is also inserted in series with the motors on the first step, and is cut out on the second step. The third step changes the connections to energise the compensating field from one portion of the transformer, and the armature and main field in series, from another portion, thus affording doubly-fed connections. The armature short-circuit is removed when the motors are operating with the double feed. Subsequent steps in the control serve to increase the motor voltages.

Each motor has a continuous rating of 200 h.p. when ventilated with 1,200 cu. ft. of air per minute. The armature is of standard construction; the commutator and the laminations are mounted on the spider, the former being undercut $\frac{1}{16}$ in. The armature is wave-wound and cross-connected, and no resistance leads are used between the windings and the commutator. The field windings consist of two entirely independent sets of coils, one being the main field circuit for producing the effective magnetic field, and the other the auxiliary or compensating winding which balances the arma-



PHILADELPHIA-PAOLI ELECTRIFICATION.—DIAGRAMS ILLUSTRATING REPULSION MOTOR PRINCIPLES.

ture reaction on the field. In addition, the latter has a neutralising effect on the sparking voltage. The field consists of six poles, the coils being of copper bars suitably insulated, connected at the ends by straps.

The use of the repulsion-starting principle is an important feature of the installation. Hitherto it has not been the practice to short-circuit the armature of an A.C. commutator motor, and the adoption of this plan is of more than passing interest.

The invention of the repulsion motor is due to Prof. Elihu Thomson, who more than twenty-five years ago developed the scheme shown diagrammatically at A in the diagram. This represents a two-pole motor having field coils wound on laminated field cores and connected to an A.C. supply line, an armature with brushes and coils connected to the commutator bars as in a D.C. motor, and a connection short-circuiting the brushes. The brushes are shifted from the normal position as shown.

If the brushes were placed under the middle of the field poles, the magnetic field flux would pass transversely through the spaces inclosed by the armature coils, and a current would flow between brushes, because the passage of alternating magnetic flux through a loop of wire sets up current flow in the wire, in accordance with the well-known principle on which a transformer operates. The short-circuiting of the brushes would permit a current that would be limited only by the impedance of the electric circuit. This flow of current in the short-circuited coils would set up torque, because each conductor would be within a magnetic field. No net torque would be produced, however, because the current would flow in the armature conductors in opposite directions on opposite sides of the brushes and the torques produced on the two sides of the armature would balance each other. But if the brushes are shifted as shown in diagram A, the balance is disturbed and net torque is produced, because the torque of

the windings on one side of the brushes overcomes the lesser torque of the windings on the other side.

The principle of the repulsion motor can be explained also by means of the second diagram, shown at B. This motor is equivalent in every way to the preceding. Here the winding is represented as divided into two parts, main and auxiliary coils, one furnishing the field for the production of torque and the other inducing the armature current. It is evident that the compensating winding used in the A.C. series motor, shown crudely in principle in C, could be used as an auxiliary winding, to produce a shifting of the magnetic field equivalent to a shifting of the brushes. A series motor can therefore be readily adopted to repulsion starting.

In the Philadelphia-Paoli motor the original scheme of Professor Thomson is still further modified by the addition of the series connection of armature and field. The armature and field windings are therefore both "conductively" and "inductively" connected. To the extent, however, that current is induced in the short-circuited armature because of the transformer effect of the auxiliary winding it is a repulsion motor. On account of the low resistance of the armature short-circuit the induced current during the starting period has a high value.

VALIDITY OF PRE-WAR POWER CONTRACTS

A N interesting action in regard to power supply contracts is pending between Messrs. Taylor & Farley and the West Bromwich Corporation. The matter was before Mr. Justice Neville in the Chancery Division on Friday, when an injunction was asked for restraining the Corporation from carrying out a threat to restrict or cut off altogether the supply of electricity at present being given. It appears that a contract was entered into on November 13th, 1912, under which the Corporation was to give a supply of electrical energy at 480 volts for five years at an agreed price per unit on the understanding that a minimum of 80,000 units per annum would be taken.

As a result of the increased cost of fuel since the war started the Corporation had already increased the charges to its ordinary power consumers by 20 per cent., and has just increased them by a further 15 per cent. At the time this second increase was made the Corporation informed Messrs. Taylor & Farley that, as they were demanding a far larger quantity of electricity than was anticipated at the time their contract was entered into—the firm is now taking at the rate of 200,000 units per annum—it was proposed to increase the price under the agreement by 20 per cent., and that in the event of the Company not agreeing to this increase the amount of energy supplied would either be reduced or cut off altogether, as might be most convenient to the Corporation. It was subsequently threatened that from December 20th the supply would be cut off between 4 p.m. and 6 p.m. each day.

When the case came before the Court it was claimed on behalf of Messrs. Taylor & Farley that the Corporation is bound by the agreement of 1912, and further that any curtailment of the supply would be a serious matter, having regard to the nature of the work now being carried out by them.

Mr. Justice Neville granted an interim injunction extending over Christmas, until the first Friday of the next sittings, when the matter will again be mentioned.

Northampton Institute.—The annual prize distribution took place on Friday, the conversazione being abandoned this year. Dr. Mullineux Walmsley, the Principal, in his report refers to the reduction in the number of students owing to enlistment—no less than 226 students and 119 members of the Polytechnic, together with 22 members of the staff, having joined the Forces. Of these, 50 have obtained Commissions in one or other of the Services. On the whole, the work of the Institute followed more or less the usual lines, notwithstanding the depletion, the falling off in students being estimated at about 24 per cent. The work of the Polytechnic has continued to receive the cordial support of the trades affected, and for the eleventh year in succession it has been in a position to place, without payment of premiums, the whole of the second and third year engineering students in commercial workshops for the summer. As a matter of fact, this was easier than usual, because by Easter the loss of skilled workers was making itself felt in all engineering trades.

Enemy Patents.—The Board of Trade have made an order permitting persons living and carrying on business in the United Kingdom to pay the fees for obtaining the grant of, or renewal of, "enemy" patents, or for obtaining the registration of designs or trade marks or renewals of same and to pay enemy agents their charges and expenses. Similarly it is permissible to pay on behalf of an "enemy" fees due in converse circumstances.

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RECENT DEVELOPMENTS IN INCANDESCENT LAMPS

AT the Illuminating Engineers' Society on Tuesday last week a discussion took place upon recent developments in electric incandescent lamps in relation to illuminating engineering. Professor Silvanus P. Thompson, F.R.S., was in the Chair.

Dr. J. T. Morris opened the discussion, and after tracing the history of the electric incandescent lamp from the earliest Swan lamp, dealt at some length with the tendency to adopt horizontal spiral filaments instead of the vertical hair-pin type. One advantage of these, he said, is that the light can be controlled more easily, although his experience had been that the life is something like 20 per cent. shorter. This, however, he did not regard as serious, because the cost of current in a lighting installation was very much larger than the cost of lamps, and even with a life of only 200 or 300 hours the total running cost of an installation might be less than with the older type of filament on account of the greater efficiency of the spiral filament. Professor Morris described the new arc-incandescent lamp which is now being developed by the Ediswan Co.; this was described in our issue of Dec. 9th, and is further illustrated this week. In this connection tests of the relation of candle-power to voltage which Professor Morris has carried out are interesting. Whereas with the carbon filament lamp a 1 per cent. change in voltage usually means a 6 per cent. change in candle-power, with the new arc-incandescent lamp the change of candle-power with 1 per cent. variation in voltage is only $\frac{1}{4}$ per cent. Finally Professor Morris made a suggestion that with these new forms of spiralled filament lamps a polar curve should be given on the wrappings they are sold in, so that the purchaser would have a good idea of what the candle-power was supposed to be in particular directions.

Following Professor Morris's remarks, Mr. S. R. Mullard exhibited and demonstrated the new arc-incandescent lamp of the Edison & Swan Co., and pointed out that they have been made in the laboratories up to 1,200 candle-power, both electrodes being of tungsten.

Mr. F. W. Willcox (British Thomson-Houston Co.) discussed in some detail the change in designs and character of fittings necessitated by the introduction of the half-watt lamp in particular, and spiralled filament lamps in general, but did not share Professor Morris's view that this type of filament would necessarily replace the vertical filament. This could only be, he said, if there was greater efficiency, as in the case of the half-watt lamp. Being a much shorter filament, the spiral was bound to be much hotter, and consequently the life shorter.

Several other speakers took part in the discussion, including Mr. W. R. Cooper, who asked for further details of the arc-incandescent lamp; Mr. A. E. Cunningham, of the London & South Western Railway Co., who raised the question of the necessity for standardising the expression of the candle-power of these new forms of lamps, and also discussed the advantages of under-running half-watt lamps; Mr. E. Stroud, of the Holophane Company, who disagreed with Mr. Willcox that it is necessary to have special reflectors for half-watt, and horizontal filament lamps, although he agreed that greater care is necessary in adjusting the position of the lamp in the reflector in order to get the illumination in any desired direction; and Mr. L. Gaster, who urged manufacturers not to push these new forms of lamps until they are absolutely satisfactory from every point of view.

In winding up the discussion, Professor Silvanus Thompson twitted manufacturers in connection with the high prices now charged for incandescent lamps, which, he said, he was quite certain was very much higher than they need be.

The Institution and Enemy Members.—The *Journal* of the Institution of Electrical Engineers for December 15th states that representations have been made to the Council by certain members to the effect that members of enemy origin and nationality should be excluded from membership. It is pointed out, however, that the Council is legally advised that the only powers of expulsion which the Institution or its Council appears to have are those contained in Article 41 of the Articles of Association. May we remind the Council, however, that there is nothing to prevent, if it is thought advisable, the Articles of Association being revised at a special general meeting of the members? A letter on this subject appeared on p. 492 of our issue for December 9th.

The B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.: Cole, Marchent & Morley; Hick, Hargreaves & Co.; The Edison & Swan United Electric Light Co.

THE REPULSION-STARTING TRACTION MOTOR

THE adoption of single-phase power supply with repulsion-starting series motors, for the electrification of the suburban line of the Pennsylvania Railroad at Philadelphia, marks a new step in the progress of electric traction. The electrified section of this railway, which is described at length in the *Electric Railway Journal*, is about 20 miles long, and the rolling-stock consists of 93 all-steel cars, all equipped as motor cars.

Each car is provided with two 225-h.p. Westinghouse single-phase, air-blast-cooled motors, mounted on one truck. All the main electrical apparatus is placed at one end of the car, and the brake equipment at the other, giving about 60 per cent. of the total car weight on the driving wheels. The motors are connected in series, and are started and operated up to 15 miles per hour as repulsion motors, with the compensating field, the armature, and the main field in series. With these series connections the armature is short-circuited through resistance. Resistance is also inserted in series with the motors on the first step, and is cut out on the second step. The third step changes the connections to energise the compensating field from one portion of the transformer, and the armature and main field in series, from another portion, thus affording doubly-fed connections. The armature short-circuit is removed when the motors are operating with the double feed. Subsequent steps in the control serve to increase the motor voltages.

Each motor has a continuous rating of 200 h.p. when ventilated with 1,200 cu. ft. of air per minute. The armature is of standard construction; the commutator and the laminations are mounted on the spider, the former being undercut 1/16 in. The armature is wave-wound and cross-connected, and no resistance leads are used between the windings and the commutator. The field windings consist of two entirely independent sets of coils, one being the main field circuit for producing the effective magnetic field, and the other the auxiliary or compensating winding which balances the arma-

the windings on one side of the brushes overcomes the lesser torque of the windings on the other side.

The principle of the repulsion motor can be explained also by means of the second diagram, shown at B. This motor is equivalent in every way to the preceding. Here the winding is represented as divided into two parts, main and auxiliary coils, one furnishing the field for the production of torque and the other inducing the armature current. It is evident that the compensating winding used in the A.C. series motor, shown crudely in principle in C, could be used as an auxiliary winding, to produce a shifting of the magnetic field equivalent to a shifting of the brushes. A series motor can therefore be readily adopted to repulsion starting.

In the Philadelphia-Paoli motor the original scheme of Professor Thomson is still further modified by the addition of the series connection of armature and field. The armature and field windings are therefore both "conductively" and "inductively" connected. To the extent, however, that current is induced in the short-circuited armature because of the transformer effect of the auxiliary winding it is a repulsion motor. On account of the low resistance of the armature short-circuit the induced current during the starting period has a high value.

VALIDITY OF PRE-WAR POWER CONTRACTS

AN interesting action in regard to power supply contracts is pending between Messrs. Taylor & Farley and the West Bromwich Corporation. The matter was before Mr. Justice Neville in the Chancery Division on Friday, when an injunction was asked for restraining the Corporation from carrying out a threat to restrict or cut off altogether the supply of electricity at present being given. It appears that a contract was entered into on November 13th, 1912, under which the Corporation was to give a supply of electrical energy at 460 volts for five years at an agreed price per unit on the understanding that a minimum of 80,000 units per annum would be taken.

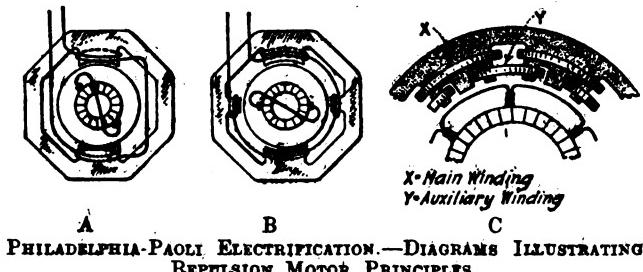
As a result of the increased cost of fuel since the war started the Corporation had already increased the charges to its ordinary power consumers by 20 per cent., and has just increased them by a further 15 per cent. At the time this second increase was made the Corporation informed Messrs. Taylor & Farley that, as they were demanding a far larger quantity of electricity than was anticipated at the time their contract was entered into—the firm is now taking at the rate of 200,000 units per annum—it was proposed to increase the price under the agreement by 20 per cent., and that in the event of the Company not agreeing to this increase the amount of energy supplied would either be reduced or cut off altogether, as might be most convenient to the Corporation. It was subsequently threatened that from December 20th the supply would be cut off between 4 p.m. and 6 p.m. each day.

When the case came before the Court it was claimed on behalf of Messrs. Taylor & Farley that the Corporation is bound by the agreement of 1912, and further that any curtailment of the supply would be a serious matter, having regard to the nature of the work now being carried out by them.

Mr. Justice Neville granted an interim injunction extending over Christmas, until the first Friday of the next sittings, when the matter will again be mentioned.

Northampton Institute.—The annual prize distribution took place on Friday, the conversazione being abandoned this year. Dr. Mullineux Walmsley, the Principal, in his report refers to the reduction in the number of students owing to enlistment—no less than 226 students and 119 members of the Polytechnic, together with 22 members of the staff, having joined the Forces. Of these, 50 have obtained Commissions in one or other of the Services. On the whole, the work of the Institute followed more or less the usual lines, notwithstanding the depletion, the falling off in students being estimated at about 24 per cent. The work of the Polytechnic has continued to receive the cordial support of the trades affected, and for the eleventh year in succession it has been in a position to place, without payment of premiums, the whole of the second and third year engineering students in commercial workshops for the summer. As a matter of fact, this was easier than usual, because by Easter the loss of skilled workers was making itself felt in all engineering trades.

Enemy Patents.—The Board of Trade have made an order permitting persons living and carrying on business in the United Kingdom to pay the fees for obtaining the grant of, or renewal of, "enemy" patents, or for obtaining the registration of designs or trade marks or renewals of same and to pay enemy agents their charges and expenses. Similarly it is permissible to pay on behalf of an "enemy" fees due in converse circumstances.



PHILADELPHIA-PAOLI ELECTRIFICATION.—DIAGRAMS ILLUSTRATING REPULSION MOTOR PRINCIPLES.

ture reaction on the field. In addition, the latter has a neutralising effect on the sparking voltage. The field consists of six poles, the coils being of copper bars suitably insulated, connected at the ends by straps.

The use of the repulsion-starting principle is an important feature of the installation. Hitherto it has not been the practice to short-circuit the armature of an A.C. commutator motor, and the adoption of this plan is of more than passing interest.

The invention of the repulsion motor is due to Prof. Elihu Thomson, who more than twenty-five years ago developed the scheme shown diagrammatically at A in the diagram. This represents a two-pole motor having field coils wound on laminated field cores and connected to an A.C. supply line, an armature with brushes and coils connected to the commutator bars as in a D.C. motor, and a connection short-circuiting the brushes. The brushes are shifted from the normal position as shown.

If the brushes were placed under the middle of the field poles, the magnetic field flux would pass transversely through the spaces inclosed by the armature coils, and a current would flow between brushes, because the passage of alternating magnetic flux through a loop of wire sets up current flow in the wire, in accordance with the well-known principle on which a transformer operates. The short-circuiting of the brushes would permit a current that would be limited only by the impedance of the electric circuit. This flow of current in the short-circuited coils would set up torque, because each conductor would be within a magnetic field. No net torque would be produced, however, because the current would flow in the armature conductors in opposite directions on opposite sides of the brushes and the torques produced on the two sides of the armature would balance each other. But if the brushes are shifted as shown in diagram A, the balance is disturbed and net torque is produced, because the torque of

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 16th, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

23,113/14. **Renewable Lamps.** E. TERRY. Incandescent lamps with the filament supports mounted upon a removable stopper inserted in the neck of the bulb. Provision is made for exhausting through a passage in the neck, and mercury is made use of in keeping the plug airtight. (One figure.)

2,386/15. **Circuit-breakers.** B.T.-H. Co. (*G.E. Co., U.S.A.*) Circuit-breakers with a magnetic blow-out, the field for which is provided by pieces of magnetic material on both the fixed and moving contacts. (Two figures.)

5,943/15. **Switches.** G. GILES. An improved and simplified form of air-break high-pressure switch mounted on a single porcelain insulator, and having one or more auxiliary contacts carrying resistance to diminish the current as the circuit is being broken. (Four figures.)

8,458/15. **Conduit Joints.** F. W. URBN and A. GAMBLE. The sleeves, sockets, fittings, &c., are made with a series of longitudinal slots at the ends, and a sliding collar which can be drawn forward to tighten the slotted ends over the tube. The interior of the sleeve is roughened to tear the enamel off the tube as it is pushed in to ensure electrical continuity. Sharp projections on the clamping ring projecting through the slots may also be provided for the same purpose. (Five figures.)

9,158/15. **Cookers.** THE JACKSON ELECTRIC STOVE CO., LTD., R. C. GRIESBACH, H. H. HOLMES, C. H. SMITH, and F. H. WILLIAMS. Self-contained electric cooking utensils without flexible leads, arranged to plug into a "hob," with the contacts interlocked so that current cannot be switched on till the utensil is in the proper position for cooking, nor the utensil removed till the current is switched off. Further, the circuit can only be opened when the lowest valve of the current provided for by the various degrees of heat is on. (Five figures.)

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

DYNAMOS, MOTORS, AND TRANSFORMERS: DUCKHAM [Oil-cooled transformers] 9,110/15.

Incandescent Lamps: B.T.-H. Co. (*G.E. Co., U.S.A.*) [Exhausting lamps] 1,088/15.

Instruments and Meters: BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD. [Meters] 5,554/15; FAWSSETT [Temperature compensation of meters] 7,271/15.

Switchgear, Fuses, and Fittings: CURTIS, SHORT, and IGRANIC ELECTRIC CO. [Controllers] 23,171/14; WATSON, WATERS, and CALLENDER'S CABLE & CONSTRUCTION CO. [Protective system] 23,749/14; TORCHIO [Reactance coils] 3,433/15; MCRAE and

RUSSELL [Arc deflector] 8,303/15; SOC. GÉNÉRALE DES CONDENSATEURS ELECTRIQUES [Excess voltage protection] 15,148/15.

Telephony and Telegraphy: SOC. MARIUS LATOUR ET COMPAGNIE [High-frequency transformers for wireless telegraphy and telephony] 4,345/14; IMRAY (*Siemens & Halske A.G.*) [Telephone circuits] 939/15; MARKS (*Delany Foreign Co.*) [Telegraphic apparatus] 2,164/15.

Traction: BALLINGTON & SHAW [Signalling and train-stopping apparatus] 28,641/14; TURNER [Safety device for electric cars] 8,376/15.

Miscellaneous: GROVE [Magnetic compasses] 21,411/14; NEWTON and NEWTON BROTHERS [Magnetic clutches and brakes] 22,893/14; BENDIXEN and MOUNTAIN [Fire alarms] 23,726/14; BURDON (*Siemens-Schuckert Ges.*) [Galvanic batteries] 112/15; GOBY [Spark quencher] 1,612/15; CHARLEBOIS [Electromagnetic and vacuum lifters] 1,684/15; STERN [Signalling] 3,419/15; GUS and BRITISH EVER-READY CO. [Illuminated writing implements] 13,611/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

Heating: CLEMENTS [Soldering irons] 16,452/15.

Electrometallurgy: COCHLOVIUS [Electric furnaces] 16,602/15. **Telegraphy:** SIEMENS & HALSKE A.G. [Spark gaps for wireless telegraph oscillatory circuits] 14,696/15.

Miscellaneous: SATINOVER [Electric fly-traps] 16,044/15.

Applications to Suspend or Avoid Enemy Patents

21,750/09, 24,389/10, 19,473/11, 16,165/12, 218/13, 1,179/13, and 25,180/13. **Th. GOLDSCHMIDT. Rail Welding.** Applications by The British Thermit Co., Ltd., relating to these patents, all of which have reference to the Thermit system of welding tramway rails *in situ*, will be heard to-morrow.

Expiring and Expired Patents

The following Patents expire during the current week, after a life of fourteen years:—

26,340/01. **Controllers.** B.T.-H. Co. (*C. Holz, U.S.A.*). A blow-out arrangement for controllers of the tramway type, in which the field produced by the single blow-out coil embraces the whole range of the contact fingers.

26,344/01. **Cables.** B.T.-H. Co. (*W. Le R. Emmett and W. S. Clark, U.S.A.*). Cables insulated with varnished fabric with the successive layers arranged to break joint, and sealed at the joints by a viscous insulating medium.

The following are the more important Patents that have become void through non-payment of renewal fees.

Arc Lamps, &c.: A. G. BLOXAM [Arc lamp electrodes] 20,311/09.

DYNAMOS, MOTORS, and TRANSFORMERS: M. WALKER [Split-pole machines] 18,870/02; B.T.-H. Co. (*G.E. Co., U.S.A.*) [Centrifugal clutches for single-phase induction motors] 18,369/08.

Electrochemistry and Electrometallurgy: J. Y. JOHNSON (*Badische Anilin & Soda Fabrik*) [Arc furnaces for treating gases] 20,129/09.

TRACTION: SIEMENS BROTHERS DYNAMO WORKS [Supports for overhead conductors in tunnels] 18,222/08.

return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,474.

Describe in detail the best practical methods used to-day for boosting up the voltage of defective individual cells in a battery. What is the cause of, and remedy for, this defection of single cells?

(Replies must be received not later than first post, Thursday, Dec. 30th.)

ANSWERS TO No. 1,472.

When replacing an E.H.T. 3-phase switch (which had accidentally been tripped) it was noticed that the reading on the switch ammeter went up to nearly 20 amps., and then gradually died down to almost zero. The current was switched on to

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the

two transformers, a 100 and a 50 k.v.a. respectively. What would cause the momentary excessive rise in current? On another occasion, when switching in, there was no rise whatever on the ammeter beyond the transformer current. Is such a rise in any way bad for the transformer from a practical or theoretical point of view?—H. H.

The first award (10s.) is given to "Alpha" for the following reply:—

Under normal conditions the flux in an unloaded transformer supplied with a sine wave of E.M.F. will be represented by a sine wave lagging 90° behind the E.M.F., and the magnetising current by an alternating wave also lagging nearly 90° , and more or less peaked according to the degree of saturation of the transformer iron. If the switch connecting the transformer to the line is closed at the instant of the maximum value of the E.M.F. and there is no residual magnetism in the transformer, the flux and magnetising current both start from zero, as shown in the top left-hand diagram of Fig. 1, and the transformer takes its normal magnetising current at once. If, however, the switch is closed

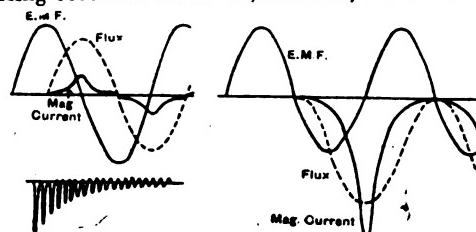


FIG. 1.

when the voltage is zero (see the right-hand diagram), it is evident that the flux wave will still start from zero (assuming no residual magnetism), although at this point of the voltage wave it would normally be at a maximum. Since the total change of flux is the same for a given E.M.F. cycle, the maximum value of the flux will reach double its normal maximum at the end of the first half cycle. This means that the magnetic density in the transformer iron will reach, say, 150 kilolines per sq. inch instead of the normal value of, say, 75 kilolines, i.e., the iron will be highly saturated, and the magnetising current correspondingly great, perhaps 20 times normal current.

At the end of the first cycle the flux and magnetising current will have returned to zero, and the magnetising current will therefore consist of a pulsating, unidirectional wave, rising (due to the high saturation) to a very high value. This may be considered as a transient, pulsating current superimposed on the normal magnetising current, and the effect of the losses in the transformer is to gradually damp out the transient current, so that the magnetising current after a few cycles will have dropped back to its normal condition, as indicated in the smaller diagram on the left, which is drawn to a smaller scale. If there is any residual magnetism in the core at the instant of switching on, the total change of flux must still remain the same, so that the maximum value reached will be either increased or decreased, depending on the direction of the residual. The effect of residual magnetism may therefore be to still further increase the saturation, and hence the magnetising current. From the above it will be evident that the reading given by the ammeter at the instant of switching on will depend on the point of the voltage wave at which the switch makes contact, and also upon the amount and direction of the residual magnetism in the transformer iron.

Since the normal magnetising current of a transformer may be taken as about 5 per cent. of the full load current, a rush of twenty, or even thirty, times this amount will not be sufficient to cause overheating or mechanical damage, and it may therefore be considered harmless to the transformer, although the writer knows of at least one case where the switching of a large transformer on to a comparatively small supply caused sufficient disturbance to trip the generator oil-switch and interrupt the supply.

In addition to the above effect there will be a high frequency current at the moment of switching on, due to the distributed capacity and inductance of the transformer windings. This will, however, be of much too high a frequency to give a reading on an ordinary ammeter, and is quite negligible except on circuits of, say, 50,000 volts and over, where it may cause a breakdown of the transformer insulation. At lower voltages than this the distributed capacity of the windings is practically nil.

The second award (5s.) is given to "S. A. S." for the following reply:—

The explanation of the excessive current rush at the instant

of switching in the three-phase transformers mentioned by "H. H." is as follows:—

The value of the current rush at the moment of switching in is principally determined by the point on the voltage wave at which switching occurs. The flux, being 90° out of phase with regard to the voltage, will attain to its maximum value when the voltage is zero, and vice versa. Now suppose the instant of switching in occurs when the voltage wave is at its zero value, and the flux consequently at its maximum. To produce any half-cycle voltage wave (say, zero to zero) it is necessary that the flux varies from a maximum negative to a maximum positive, thus embracing a total number of lines equal to twice the maximum induction. At the instant previous to switching there was no flux in the transformer circuit. But as soon as contact is made by the switch a flux must be set up which will uphold the voltage generated, and it is obvious that this flux must start from zero, since there is no flux in the transformer cores (assuming no residual magnetism). And that, further, the flux must also reach a value above zero equal to twice the maximum induction. Fig. 2 shows the voltage and flux waves from the instant of

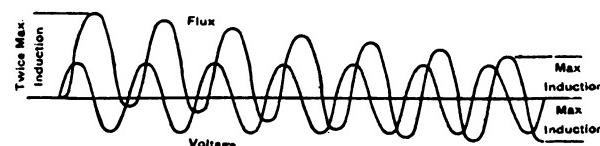


FIG. 2.

switching in till the flux adjusts itself to the normal conditions. It will be seen that the first half-cycle fulfils the above conditions, since the rate of change of flux is unaltered, and therefore the voltage is upheld. Since there is a definite ohmic drop in the circuit, however, the flux will not continue to pulsate equally as in the first half-cycle, but will rapidly adjust itself to the normal positive and negative value, as shown in the succeeding cycles.

Now by referring to Fig. 3, which shows a typical B-H

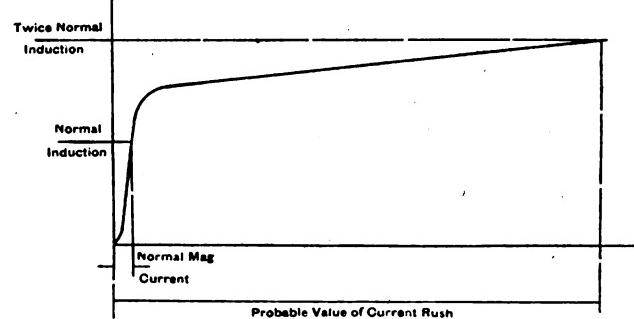


FIG. 3.

curve for commercial transformer iron, it will be seen that with a maximum induction of twice the normal the magnetising current will be increased out of all proportion. The current corresponding to this high induction is the value noted on the switch ammeter, and may reach to many times the normal full-load current. The rush of current will, of course, die down, as noted by "H. H.", due to the rapid adjustment of the flux.

If switching in had occurred when the voltage wave had its maximum value, no rise in current would have been recorded. The flux value corresponding to maximum voltage would be zero, and since there was no flux in the transformer cores there would be no tendency towards instability. The flux attains to its normal positive and negative values, and the current flowing is the normal no-load current.

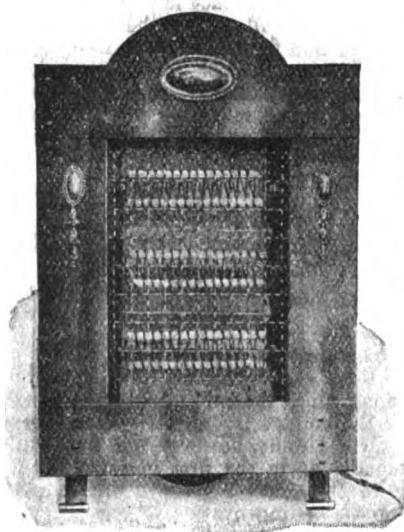
The current rush may attain to a larger value if the transformer cores contain residual magnetism, since the maximum induction will be increased by the number of lines positive remaining in the cores at the moment of breaking the circuit. If the residual magnetism is negative, then conversely the current rush may be smaller.

Trouble may result from severe current rushes, principally due to the heavy mechanical stresses set up between coils, and also to high voltages generated.

Rugby Engineering Society.—It has been decided that no papers or lectures will be given this session, in view of the fact that the time of the officials and members is largely occupied with war work, and that, owing to so many members having joined his Majesty's forces, the effective membership is greatly reduced. As far as possible the officials who were elected for session 1914-15 will continue to serve for the present session. In view of the above, the subscription will be reduced to 2s. 6d. for the present session.

DOWSING HEATING AND COOKING APPARATUS

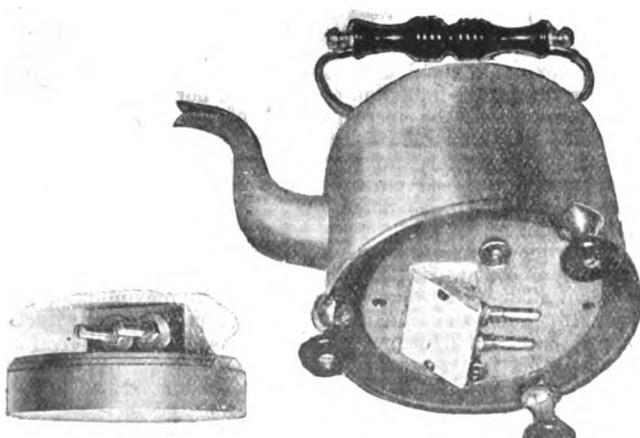
THE Dowsing Radiant Heat Co., Ltd. (39/40 York Place, Baker Street, W.), has issued a new and very complete list of electric radiators and heating apparatus. This firm, which has been making electric radiators for the past 20 years, originated the luminous system of heating, and subsequently non-luminous and bare-wired types of heaters. Special attention may now be called to the various new types of hot-bar radiators, and to a radio-convector pattern of heater. These radiators act in precisely the same manner as hot-water radiators, i.e., the air is warmed by coming into contact with



DOWSING ELECTRIC FIRE.

a heated surface. For this purpose two luminous heat lamps are used with non-luminous heaters. One of our illustrations shows a non-luminous type of heater, the three heating elements of which are each wound to take half a unit per hour, and are guaranteed for one year. Two switches are provided, thus giving three heats.

The firm has also introduced a new rap'd boiling kettle fitted with the Dowsing & Huntley interchangeable heating element. This element, shown in another illustration, is arranged to give a maximum amount of heat in a small area; it has extremely long life, and is quite interchangeable for



INTERCHANGEABLE HEATING ELEMENT.

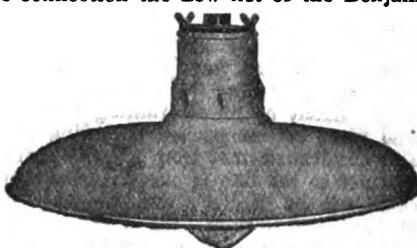
RAPID BOILING KETTLE.

various voltages. It is made under the Eastman & Warne patents, and is capable of being heavily loaded. This heating element is also applied to urns and other electric heaters. The list contains numerous types of heaters of all forms, and a smaller pamphlet deals with electric cookers, irons, grills, &c.

We may take this opportunity of pointing out the fact that, besides taking over Messrs. Eastman & Warne's business last year, the Dowsing Radiant Heat Co. recently purchased the Phoenix Electric Heating Company's business, i.e., good-will and useful stock, and have now also acquired the good-will, patterns, and secret processes for the manufacture of heating elements, drawings, and stock of heating elements of the British Prometheus Co., of Birmingham and London.

HALF-WATT LAMP FITTINGS

AS was pointed out at the last meeting of the Illuminating Engineering Society, reported on another page, the introduction of the half-watt lamp has rendered necessary considerable changes in design of reflectors and lamp fittings, and in this connection the new list of the Benjamin Electric,



DISTRIBUTING FITTING.

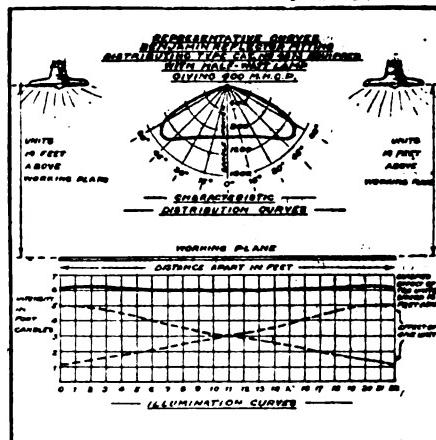
Ltd. (1A Rosebery Avenue, E.C.), is worthy of special notice. Not only is it a trade list giving prices and the usual particulars, but a quantity of valuable illuminating engineering data is given, together with definitions of terms, a method of



CONCENTRATING FITTING.

rapid calculation of illumination, and photometric curves of every type of fitting listed.

It is claimed that the range of fittings covered in the list is the most comprehensive yet produced, whilst the "Addenda" constitutes a remarkably simple form of refer-



PHOTOMETRIC CURVE OF BENJAMIN CONCENTRATING FITTING.

ence regarding the firm's apparatus. Our illustrations of distributing and concentrating types of fittings, together with a characteristic photometric curve, are typical of the large number dealt with in the booklet.

The Proposed State Control of Electricity Supply in Saxony.—According to the *Frankfurter Zeitung* of December 12th, 1915, the proposal of the Government of Saxony to create a State control of electricity supply is favoured by the Conservative party, and is certain to pass the First Chamber, while the attitude of the Second Chamber is uncertain. The scheme, if carried out, will cost the State about 58 million marks (£2,900,000), and comprises the purchase of a number of supply undertakings of various sizes, the erection of two or more large steam power stations, and the construction of an extensive 100,000-volt transmission and distribution system. The first power station will be erected at Regis, near Leipzig, and will cost about £500,000. A second in the neighbourhood of Dresden will cost about £650,000. The 100,000-volt transmission and distribution system is estimated to cost £500,000. Large coalfields near Regis and Dresden respectively have already been acquired by the Government.

THE TUNGSTEN ARC LAMP

THE Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex, and 123-125 Queen Victoria Street, E.C.), are now putting on the market the first form of tungsten arc lamp described in our issue of December 9th. This is intended for projector lanterns, and is illustrated in

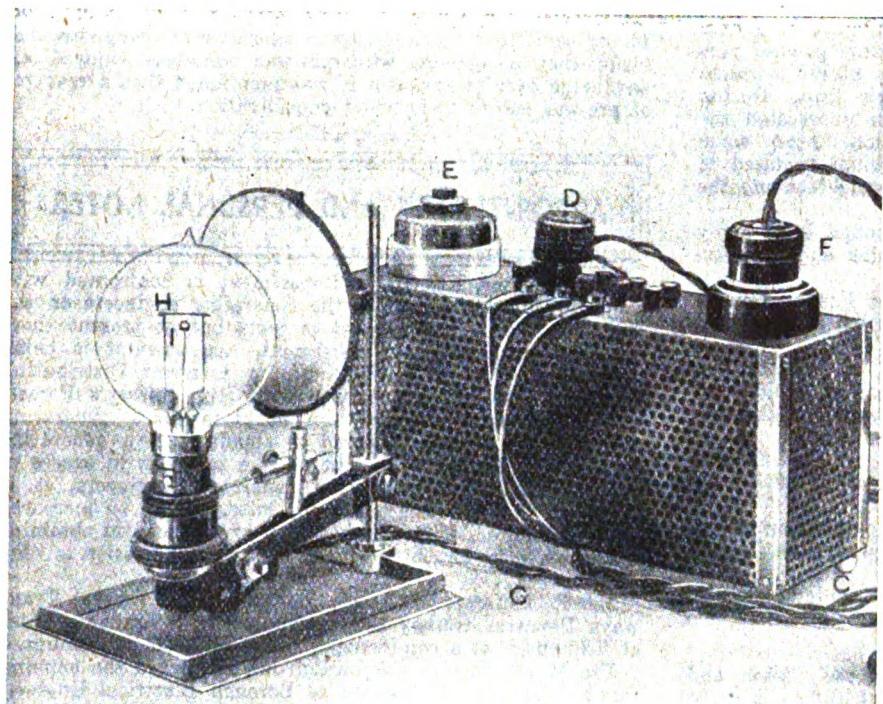


FIG. 1.—LAMP READY TO BE INSERTED IN LANTERN.

Figs. 1 and 2. The plug on the right of the resistance box in Fig. 1 is connected to an ordinary wall socket or pendant lamp through an adaptor. Three wires connect the lamp to the resistance, and when the push on the right-hand side of the resistance box is pressed it causes the ionising filament in the lamp to glow. The arc strikes almost immediately

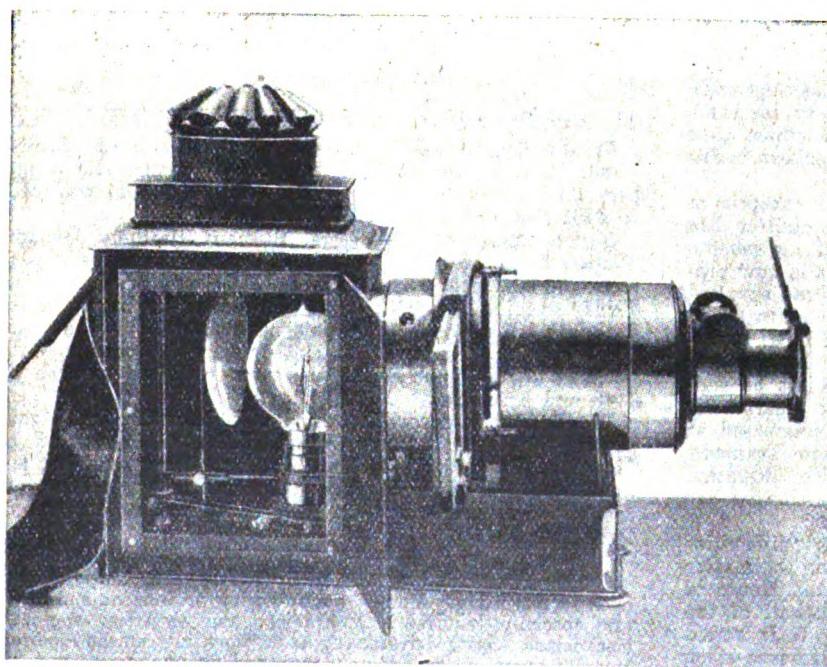


FIG. 2.—LANTERN READY FOR USE.

and the push must then be released. It is necessary to connect the lamp up with the correct polarity. The resistance box is so arranged that by means of the two-prong plug seen in the middle of the box it can be used for any voltage from 100 to 250 D.C. The lamp has been given the name of the "Pointolite" lamp.

THE "O.K." DRY CELL

WE have received from the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex, and 123-125 Queen Victoria Street, E.C.), a sample (taken from stock) of their Ediswan "O.K." dry cell, with the request that we should try it and give our opinion of it. A good dry cell should have two characteristics: It should be capable of supplying moderately large currents for some seconds, or possibly one or two minutes, at a time with only a moderate amount of polarisation and quick recovery; and it should keep in good condition without "drying up" for several months if employed only for intermittent currents of short duration with long periods of rest. As the latter property would obviously require some time to test, we decided to make a rough trial of the former one only, taking the simplest piece of apparatus nearest to hand for the purpose, viz., a small electric torch lamp.

The cell is of the ordinary "No. 2" shape and size, viz., 6 ins. high by $\frac{1}{4}$ ins. diameter, and the lamp used for the rough test, which was rather qualitative than quantitative, was a metal filament miniature lamp with a marked nominal rating of 2.25 volts and 0.17 amp.

On connecting the lamp to the terminals of the cell we obtained a good yellow glow—as is well known, such lamps are very much over-run, and give an extremely blue light at their marked voltage. We left the lamp connected to the cell for 10 minutes, without being able to observe any diminution of the light at all, so that it was apparent that some more drastic treatment was necessary. The following is the course of the "test" which we applied:—

Connected to lamp for 10 minutes.—No diminution of light.

Dead short-circuit for 1 minute.—No diminution of light.

Dead short-circuit for 2 more minutes.—Light very slightly reduced, but colour still yellow; lamp left on for 3 minutes and light improved slightly.

Dead short-circuit for 5 minutes.—Lamp only slightly fainter.

Switched off for 2 minutes, and then switched on. Lamp glowed almost at original brilliancy.

Lamp continued at original brilliancy, and after 2 minutes the cell was again short-circuited, this time for 10 minutes, and was then given 30 seconds' rest. The lamp still glowed with a yellow colour, and after one minute's rest was again short-circuited for 10 minutes. After this the lamp still glowed with a fairly good yellow colour.

Switched off battery for 8 hours' rest, after which the lamp was again switched on for two minutes and continued to glow as brightly as at the very start.

Short-circuited for 5 minutes.—Lamp still glowed, with slightly reduced brilliancy.

Eleven hours' rest.

Lamp switched on again and left on for 4 hours. Light practically as good as at the very first all the time.

Fourteen hours' rest.

Lamp switched on again, and left on for 8 hours. Light still maintained at practically the same brilliancy.

Short-circuited for 30 minutes, after which lamp glowed a dull red only.

Rest for 1 minute. Lamp glowed much brighter.

Rest for 3 more minutes. Lamp glowed at same brilliancy as before last short-circuit.

Rest for $8\frac{1}{2}$ hours.

Lamp reconnected for 30 minutes and glowed all the time at the same brilliancy as at the very start.

After this we thought it unnecessary to continue the trial, being quite satisfied that the cell certainly is "O.K." It undoubtedly complies with the first characteristic set out above, and we may have something to say about its durability later on.

TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Kingston.—A Local Government Board inquiry was held last week concerning a loan of £16,792 for the general purposes of the electricity undertaking. Of this £5,792 is excess expenditure, leaving £11,000 as actual new loan. During the course of the proceedings the Inspector deprecated the policy of spending money without sanction. After some discussion it was agreed to reduce the amount required to £3,307, this being sufficient to carry on for eighteen months instead of four years.

London.—The Hammersmith Borough Council is to apply for a loan of £3,000 for extensions to mains and services, transformers, &c.

Islington.—The Finance Committee of the London County Council recommend sanction to a loan of £985 for electrical purposes.

St. Pancras.—The Finance Committee of the London County Council recommend sanction to a loan of £15,000 for a new turbo-generator, subject to an acceleration in the rate of repayment of certain outstanding 42 years loans.

Marylebone.—The Finance Committee of the London County Council recommend sanction to a loan of £3,800 for mains and services.

New Zealand.—The Gisborne Council contemplate an expenditure of £10,000 upon electric light and power installations and £90,000 upon tramways.

The installation of a new generating set is contemplated by the Wellington Tramways Department.

Miscellaneous

Spain.—The conversion to electricity of one 25-ton and seven 3-ton steam cranes on the wharves at Bilbao is to be carried out. Full particulars from Juntas de Obras del Puerto, Alameda de Mazarredo 3, Bilbao.

LOCAL NOTES

Birmingham: Boiler Explosion.—The Board of Trade report upon the explosion of a water-tube boiler at Chester Street power house, which took place on August 28th last, shows that the accident was due to one of the tubes opening out through wearing thin. It appears that this tube had become thin in the ordinary course of usage, and it was suggested that a few others might be withdrawn and cut to ascertain their condition. At the same time the report states that care is taken at the power house to work the boilers under favourable conditions.

Brighton: Electricity Charges.—Owing to the exceptional increase in the cost of coal, the Electricity Committee has again been compelled to come to the Council with a scheme to increase the charges for electricity supply. It is now proposed that the flat rate of 4½d. per unit for current supplied to private houses, &c., for lighting should be increased to 5½d. per unit; that the special tariffs for arc lamps, advertising signs, outdoor and basement lighting, hotels, and public-houses be abolished, and that these premises be supplied on the new flat rate. In addition, the charge for current supplied outside the Borough is to be increased to 6½d. per unit, and the present charge to the Tramway Department from 1·35d. to 1·4d. per unit. No alteration is to be made in the maximum-demand system charges nor for street lighting.

Manchester: Coal Supply Difficulties.—The difficulties which the electricity department is encountering in the matter of a regular supply of coal were mentioned in the House of Commons last week, and Mr. Runciman, on behalf of the Board of Trade, promised to make inquiries. It is stated that owing to the necessity for drawing on the reserve stock this latter has now dropped from 21,000 tons at the end of the summer to 11,000 tons.

Walsall: Position of Electricity Undertaking.—In reporting an increased consumption of coal per unit generated, the Electricity Committee point out that this is only what had been expected from the conditions which have arisen since the war. Up to a certain point the increased demands made on the electricity undertaking assisted in increasing the efficiency, but owing to the inability of obtaining new

generating plant—the Minister of Munitions having commandeered a 3,000-kw. turbo-generator on order for the new power-house—old and inefficient machinery had to be brought into use. Hence the increase in the coal bill.

West Bromwich: Increased Charges.—It is interesting to note in connection with the statement on another page of this issue with regard to the proceedings against the Corporation by Messrs. Taylor & Farley, that at the last meeting of the Corporation some objection was taken to the increase of 15 per cent. in charges to power consumers. Complaint was made that consumers with pre-war contracts enjoyed an advantage over others, and it was mentioned that a revision of pre-war contracts is under consideration.

APPOINTMENTS AND PERSONAL NOTES

The Hackney Electricity Department is confronted with some difficulty in regard to the generating engineers on the staff. Ordinarily the number is four, but at present there are only two, owing to enlistment. An attempt is being made to get Mr. A. G. Hilling, the Assistant Distributing Engineer, released from service with His Majesty's Forces, and, if successful, to use him in place of a generating engineer. It is then proposed to appoint a new generating engineer, at £3 per week, but as this salary is in excess of that received by the existing generating engineers, it is suggested that the salaries of the latter should be increased to a like figure. Difficulty has been experienced in obtaining a suitable man for the position, hence the necessity to offer £3 per week.

Mr. E. Lafferty, the Traffic Manager to the Preston Tramways Department, has been appointed to a similar position at Edinburgh at a commencing salary of £300 per annum.

The Middlesbrough Corporation has confirmed the appointment of Mr. R. H. Scotson as Borough Electrical Engineer at a commencing salary of £300 a year.

Mr. E. Lunn has been appointed Station Superintendent in Huddersfield Electricity Department in place of the late Mr. Whitwam.

Foreman wanted for view room of firm of engineers under Government control. (See advertisement on another page.)

Switchboard attendant for provincial municipal supply and tramways undertaking. (See advertisement on another page.)

MISCELLANEOUS BUSINESS NOTES AND TRADE ANNOUNCEMENTS

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £100 to £101 (last week, £97 to £98).

Christmas Holidays.—Messrs. Siemens Brothers Dynamo Works, Ltd., inform us that the Lamp and Supplies Department (38-39 Upper Thames Street, E.C.) will be closed from Friday evening, the 24th inst., till Wednesday morning, the 29th inst. For stocktaking this department will also be closed on December 30th and 31st and January 1st, but in order to meet urgent requirements the counter will be open on the 29th and 30th inst.

The British Thomson-Houston Co., Ltd., notify that Mazda House (77 Upper Thames Street, E.C.) will be closed on Saturday, December 25th, and Monday, December 27th, and for the purpose of stocktaking on December 31st and January 1st. The counter, however, will be open for business on December 31st.

London Electrical Engineers, R.E. (T.F.).—This Corps is again open to recruiting. Men of the following professions and trades are specially required: Mechanical and electrical engineers, electricians, engine drivers, engine erectors, instrument repairers, metal turners, fitters, telephonists and telegraphists, and tinsmiths. There are a limited number of vacancies for carpenters, cabinet makers, pattern makers, draughtsmen, joiners, and wood turners. Forms of particulars can be obtained from the Officer Commanding at 46 Regency Street, Westminster, S.W.

Trade with Russia.—The Sales Managers' Association are making arrangements for sending a Commissioner to Russia in the early spring to make special reports and to put British manufacturers in communication with buyers in Russia. Official support of a valuable character has already been promised.

ELECTRICAL ENGINEERING

With which is Incorporated
THE ELECTRICAL ENGINEER
(Established 1884)

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Letters for Insertion, Tuesday first post.

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TELEGRAMS: "Cycling, Fleet, London." TELEPHONE No.: 5509 Holborn
CHEQUES TO BE MADE PAYABLE TO THE KILOWATT PUBLISHING CO., LTD., AND TO BE CROSSED LONDON COUNTY AND WESTMINSTER BANK (Temple Bar Branch).

SUMMARY

At a recent joint meeting of the American Electrochemical and Illuminating Engineering Societies a Paper was read by Mr. W. A. Darrah describing a new form of tungsten arc lamp (p. 514).

THE Engineering Standards Committee has issued a specification for a standard plug and socket for charging electric vehicles (p. 514).

MR. J. R. BEARD has presented a Paper to the Institution of Electrical Engineers describing some most valuable and painstaking investigations into the design of high-pressure distribution systems based on results and observations in actual practice in the Newcastle and North-East Coast district. He included in the Paper a diagram, which we reproduce, showing the enormous extent to which the interconnection and duplication of high-pressure feeders is carried out in the above area (p. 515).

THE "James Forrest" lecture this year, written by Mr. H. M. Hobart, was read at the Institution of Civil Engineers by Mr. J. A. F. Aspinall, owing to the absence of the author in America. It dealt with electric traction on railways, and the conclusions arrived at are that we are on the eve of the extensive employment of electric locomotives on railways; that the direct-current system is the most appropriate; and that direct-current locomotives for use from high-pressure contact conductors are now a thoroughly demonstrated process (p. 516).

AT the last informal dinner of the B.E.A.M.A. the question of utilising the enormously increased capacity of engineering works—brought about by the war to good advantage when the need for munitions has passed was discussed (p. 517).

THE Engineering Standards Committee has issued a specification for 5-ampere wall plugs, making a plug with a 2-in. hand-shield the only standard (p. 517).

The insulation testing of a single-phase 3-wire network by means of a voltmeter is referred to in our Questions and Answers columns (p. 518).

AMONG the subjects of specifications published at the Patent Office last Thursday were production of high-frequency currents, motor control, feeder protection, and incandescent lamps (p. 519).

THE annual report of the Pacific Cable Board relates the story of the attack by the German cruiser *Nürnberg* and the resource shown by the staff in restoring communication after the cable had been cut and the ends dragged far apart (p. 519).

A NEW complete catalogue has been issued by Ferranti, Ltd. (p. 520).

A LOAN of £40,000 is to be taken up at Greenock; a low-tension switchboard is required at Manchester; and electrical plant for the Newton-in-Makerfield Gasworks (p. 522).

AN assisted wiring scheme is under consideration in Melbourne (p. 522).

A COMBINATION of important British electrical firms has been arranged for the purpose of developing the Russian market (p. 522).

ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS

COMPANY ORDERS BY LIEUT.-COL. C. B. CLAY, V.D., COMMANDING.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Sat., Jan. 1st: Uniform parade.

Mon., Jan. 3rd: Sections I. and II., technical. Sections III. and IV., squad. Signalling sections and recruits.

Tues., Jan. 4th: School of Arms with Architects Corps, 6 to 7. Thurs., Jan. 6th: Sections I. and II., shooting.

Fri., Jan. 7th: Sections III. and IV., technical. Sections I. and II., squad. Signalling sections and recruits.

Officer of the Week: Mon., Jan. 3rd, to Sat., Jan. 8th, Mr. L. C. Hughes Hallett.

Platoon on Duty: Mon., Jan. 3rd to Sat., Jan. 8th, No. 1 Platoon.

Sections for technical parade at Headquarters, London Electrical Engineers, 46 Regency Street, S.W.

Sections for shooting parade at miniature ranges.

Unless otherwise ordered all parades at Chester House.

Fatal Shocks from a Motor-car.—A most remarkable accident occurred at Eastbourne on Sunday last, as a result of which two men lost their lives. A Rolls-Royce car collided, without apparent cause, with a cast-iron H.T. switch pillar containing three switch fuses on a marble slab. It cut off the pillar flush with the ground, then charged a tree 2 ft. away, and stopped. All the occupants alighted without injury. Passers-by volunteered to push the car back, but in doing so brought the frame, which was insulated on the rubber tyres, in contact with one of the broken H.T. cables. As a result two men who were pushing the car fell forward on to the chassis. Policemen and others who tried in vain to remove them received severe shocks, and it was about fifteen minutes before the power station could be notified, the power cut off, and the men extricated. It was then found that life was extinct. The inquest has been adjourned in order that a representative of the Board of Trade may attend.

ANOTHER TUNGSTEN ARC LAMP

A TUNGSTEN arc lamp, made on slightly different principles to the one described in our issue of December 2nd, was the subject of a Paper presented by Mr. W. A. Darrah at a joint-meeting of the New York Section of the American Electrochemical and Illuminating Engineering Societies on November 11th. The author desired his Paper to be considered only in the light of scientific research, although, it is added by the *Electrical World* of New York, the results are very promising from a practical standpoint. In the report of the Paper published in our contemporary, the precise construction of the lamp is not quite clear in all its details, but a good deal of information is given, and we are glad to be able to re-publish it, together with the diagram below.

A study of the light efficiency of an arc from a chemical standpoint shows that there is a certain rather limited class of substances which when introduced into the arc in small quantities produce a very great increase in luminosity. Thus the addition of small quantities of cerium or calcium compounds to the carbon arc may increase its efficiency over 300 per cent., and the addition of titanium (preferably as an oxide) to the magnetite arc similarly produces an increased luminosity without a corresponding increase in energy consumption. But it is a peculiar coincidence that the addition of cerium or calcium to the magnetite arc, or of titanium to the carbon arc, does not result in approximately the same gain in efficiency. The chemical compound in which the element appears is apparently of little importance.

A study of these facts led to the conception that perhaps an

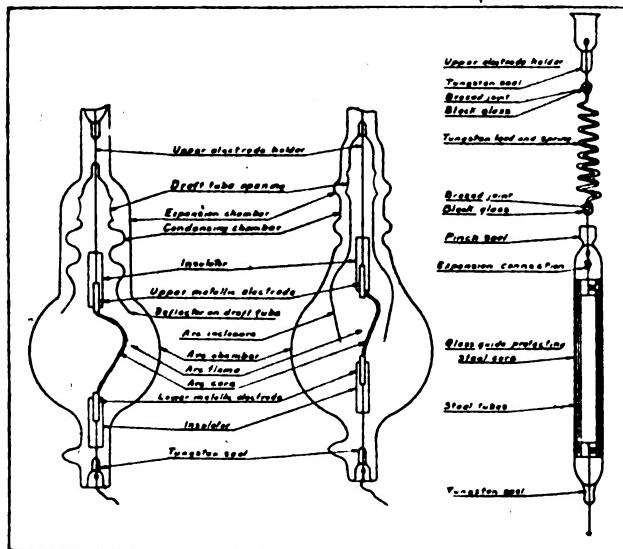


FIG. 1.

arc could be maintained in a closed vessel and supplied with these light-producing elements in the vapour form. The arrangement of the apparatus is shown in Fig. 1, which shows the latest designs. The lamp consists essentially of an arc chamber at the centre of which the arc is drawn between two tungsten electrodes about 3/16 in. in diameter. The electrodes are partly surrounded with a refractory insulator, designed to prevent the arc from moving far from the ends of the electrodes. Tungsten was found to be the most satisfactory electrode material, as it is practically inert, even at a white heat, in the presence of various vapours used.

As all the liquids employed for supplying the active vapour are hygroscopic, and many of them readily decomposed by ordinary moist air, it becomes necessary to exhaust the air from the lamp, heat the lamp and electrodes while at a low pressure in order to remove the air films, and then admit the liquids without opening the lamp chamber of the air. This was accomplished by means of a bottle sealed in the lower extremity of the lamp, and provided with a ground stop-cock connecting it with the lamp. After the proper degree of exhaustion was reached, the desired liquid was carefully poured into the bottles and the stop-cock opened slightly, when atmospheric pressure forced the liquid into the lamp chamber.

The appearance of the arc in this lamp is quite different from other commercial arc lamps. Among the vapours experimented with are antimony tetrachloride, carbon tetrachloride, stannic chloride, titanium tetrachloride, &c. The spectrum of the flame is usually quite different from the arc spectrum, and is characteristic of the elements

involved, while the spectrum of the arc independent of the ends of the electrodes (which, of course, give a hot-body spectrum) is usually a band spectrum, and is practically continuous except for a few absorption lines.

Fig. 2 shows performance curves giving the relation between arc length and voltage, and shows the rate at which additional arc lengths require an increased voltage. The curve is also interesting as indicating that a 4-in. arc at 10 amp. requires no more voltage than a 1-in. arc at 2 amp. In other words, a 10-amp. arc is four times as long; in addition, its intrinsic brilliancy is about five times that of a

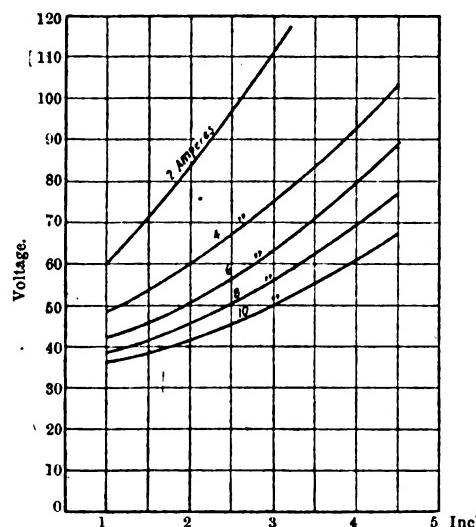


FIG. 2.—RELATION OF ARC LENGTH TO VOLTAGE.

2-amp. arc, and, accordingly, the light emitted by a 10-amp. arc under these conditions is twenty times that of a 2-amp. arc, and since the wattage of a 10-amp. arc is only about five times that of the 2-amp. arc, the efficiency is approximately four times that of the 2-amp. arc. Efficiency curves indicate that 20 amp. is approximately the point of maximum efficiency of this particular antimony pentachloride lamp.

It should be understood, however, that the current of maximum efficiency differs widely with differences in the nature and pressure of the gas as well as the volume and available radiating surface of the lamp, and very efficient titanium bromochloride lamps have been constructed with a maximum efficiency of about 5 amp.

A STANDARD CHARGING PLUG

In conjunction with the Electric Vehicle Committee of the Incorporated Municipal Electrical Association, the Engineering Standards Committee has issued a standard specification for a charging plug and socket for electrically-propelled vehicles. The design adopted is practically that illustrated in *ELECTRICAL ENGINEERING*, Vol. X., September 24th, 1914, p. 516. The object in view has been to standardise the essential details necessary to secure interchangeability between any charging plug and any socket of the design selected by the Electric Vehicle Committee, viz., concentric, leaving to them the issue of a detailed specification for the construction of the exact design of plug which, in their opinion, is best suited to the present needs of the industry. By doing so, it is felt that there will be as little interference as possible with invention and progress.

Wave-shapes of Alternators under Short-circuit.—A useful contribution to the theory of armature reaction is provided by a Paper by A. E. Clayton communicated to the I.E.E. and published in the Journal, on "The wave-shapes obtaining with alternating-current generators working under steady short-circuit conditions." The Paper is divided into four sections dealing with the ideal polyphase machine, three-phase, single-phase, and two-phase machines respectively. In each section salient pole and cylindrical field machines are considered, curves being given of magnetomotive force and flux distribution, e.m.f. in conductors, and the resulting e.m.f. per phase, and armature current. This subject serves as an excellent example of the properties of non-sinusoidal electromotive forces, and the difference in the wave-shapes of e.m.f.'s and the currents produced by them. Perhaps the most outstanding feature is the presence of marked third harmonics in the current wave of single-phase machines having a two-thirds winding.

DESIGN AND HIGH PRESSURE DISTRIBUTION SYSTEMS

AT the Institution of Electrical Engineers on December 6th, a Paper on the above subject was read by Mr. J. R. Beard (a member of the staff of Merz & McLellan). It had previously been read at Manchester, and was read at Cardiff on December 13th.

The Author referred to the growing tendency of splitting up the more extensive and cumbersome L.T. networks into several districts each fed by a separate sub-station, with the resulting increase in the size of high-tension distribution systems. One section of the Paper was devoted to a comparison of overhead and underground mains, and the Author stated that it was found in practice that the number of serious breakdowns of the former was only about double those on the latter; overhead mains are, however, more liable to transitory short-circuits causing temporary automatic disconnection of supply. For lower voltages—say from 3,000 to 6,000 volts—the saving in cost was not very great for small sizes, but for 11,000 and 20,000 volts it was considerable, as the pressure had little influence on the cost of overhead lines. This saving is often increased by saving in length in open country where roads are few. The chief disadvantages of overhead lines cited were the difficulty in obtaining way-leaves, and the results of their greater inductance owing to the conductors being further apart. The increased voltage drop, on this account, in the case of heavy mains, may be sufficient to necessitate increased section of copper or a reduction in the radius of transmission at a given voltage; there is, however, one important exception, viz., D.C. traction systems supplied through rotaries arranged to take a leading current at heavy load. If cable and overhead mains of equal section are converted in parallel, the different inductances causes the current to divide unequally. This not only prevents the two circuits being run at their most economical current density, but also, owing to the resistance losses being dependent on the square of the current, they are greater than if the current were divided equally. Further, owing to the difference in the inductance of the parallel circuits, there is a phase difference between the currents in the two branches. This results in the arithmetical sum of the currents in the branches being greater than the total current, thus causing additional resistance losses and a reduction in the carrying capacity of the circuits. To take a concrete example, assume that 300 amperes at 6,000 volts and 50 cycles is to be transmitted through a 0·15 sq. in. cable and a 0·15 sq. in. overhead line in parallel. The actual current in the cable will be 210 amperes, and in the overhead line 105 amperes, while the resistance losses are increased by 24 per cent. as compared with the losses if both circuits were either cable or overhead line.

Switchgear was next dealt with, and it was pointed out that it must not be proportioned merely in accordance with the capacity of the apparatus which it controls: its primary object is to isolate faulty apparatus and to interrupt or prevent heavy short-circuits. The breaking of a heavy short is similar to the detonation of an explosive, and, if the switch is badly designed, the tank will be blown off and the whole switch wrecked. The cause of this is the rapid generation of gas beneath the surface of the oil, and consequently air cushions and vent-pipes are not always sufficient safeguards, as, owing to the inertia of the oil, a high local pressure is transmitted hydraulically before the oil has an opportunity of moving at its free surface. A switch designed by Messrs. Hunter and Shand to overcome this by accelerating the break (Patent 11,586/1912) is arranged to draw out two arcs electrically in series, but disposed parallel and close to each other, so that a repulsive effect proportional to the square of the current is exerted. The author does not approve of the use of reactance coils except on the generator mains.

Other points in connection with switchgear mentioned in the Paper were the desirability of limiting the number of potential transformers and always connecting them to the bus-bars through an oil-switch; the interlocking of main oil switches and isolating links; and the interlocking of the guarding arrangements or screens with the switchgear mechanism. An arrangement to facilitate the routine earthing of feeders was also suggested. By using permanent earthing switches it is a simple matter to interlock at the earthing end so as to ensure that the earthing switches cannot be closed until the oil-switch is opened, and vice versa.

The author next investigated the problem of the most economical section of mains, and showed that the law that the most economical section is that at which the sum of the annual charges and the value of the energy lost is a minimum, is commercially applicable to cables of high-pressure distribution systems. The annual charges taken for underground and overhead mains at various voltages are shown in Fig. 1. These are based on average commercial prices, allowing interest at the rate of 5 per cent. per annum, and depreciation at 2 per cent. for underground mains, and 3 per cent. for overhead mains, suitable allowance being made for trench work in the former case, and for wayleave charges in the latter. With compound interest at 5 per cent. the rates allowed for depreciation are sufficient to enable the underground mains to be replaced after 22½ years

and the overhead mains after 17½ years, allowing a scrap value of 20 per cent. in each case. In the case of overhead mains only one curve is given, as up to 20,000 volts the only difference is in the insulators, and this is very small. The only losses important enough to be taken into account in this investigation are the resistance losses and their effect on the load factor of the system considered as a whole. It is pointed out that these losses constitute a load which is far from beneficial, as there is no diversity between the curve of losses and the main load curve; in fact, the peaks are accentuated because the resistance losses vary as the square of the load. Assuming a system with a maximum load of 50,000 kw. and an average load factor of

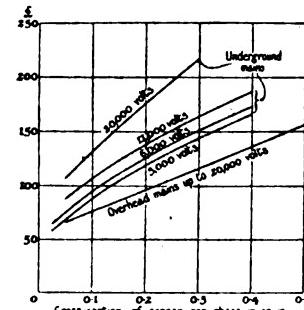


FIG. 1.—ANNUAL COST PER MILE OF INTEREST AND DEPRECIATION FOR VARIOUS TYPES OF 3-PHASE MAINS.

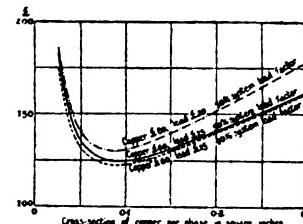


FIG. 2.—COMBINED ANNUAL COST OF INTEREST, DEPRECIATION, AND ENERGY LOSSES PER MILE OF 6,000-VOLT UNDERGROUND MAIN CARRYING A MAXIMUM LOAD OF 100 AMPERES.

50 per cent., and the cost of the distribution system as two-thirds that of the power stations, the value of the resistance losses in the typical system considered is taken at 0·25d. per unit.

By adding the curves of annual charges and value of losses for mains of various sizes for any particular maximum current, a curve is obtained of the type shown in Fig. 2, which refers to a 6,000-volt underground cable required to deal with a maximum current of 100 amperes. The most interesting feature of this curve is that the most economical section is not very definite; it is actually 0·09 sq. in., but for 2½ per cent. increase in the total annual costs the section can be increased 44·5 per cent., or decreased 27·2 per cent., the corresponding figures for 5 per cent. increase in annual costs being 65·5 per cent. and 36·1 per cent. respectively. It follows that it is not sound practice to cut the section of mains too fine, more especially since it is a most expensive matter after a main is once laid to increase its carrying capacity if this should prove too small.

In order to see to what extent the results are dependent on the particular system load factor selected, a corresponding curve has been calculated in exactly the same way but assuming a system load factor of only 40 per cent. This is shown dotted in Fig. 2, and gives a reduction of only 2 per cent. in the most economical section and 2 per cent. in the minimum total annual cost per mile, compared with the original curve. A further curve has been added (chain dotted); this shows that the influence of ordinary variations in metal prices is negligible.

Another series of curves given in the Paper show that up to 11,000 volts in the case of underground mains, and up to 20,000 volts in the case of overhead mains, the voltage makes no difference to the economical cross-section, because, between those limits, the annual charges happen to differ by approximately constant quantities which are independent of the cross-section. Except for 20,000-volt cables, the economical section gives an overload margin of as much as 100 per cent. in nearly all cases, and even for 20,000-volt cables a considerable margin exists.

In discussing the lay-out of the distribution system, the Paper laid stress on the desirability of each sub-station having at least two separate sources of supply, and some form of discriminating protective device isolates a feeder automatically in the event of its breakdown. For this purpose the author advocated unconditionally the balanced-current protective system with pilot wires or the split-conductor protective system. He denied that they really involve extra capital cost, contending that the extra cost per mile was counterbalanced by the saving effected by using an interconnected system. This reduced the number of spare feeders, enabled a number of small feeders to be replaced by a few large ones, reduced the switchgear required, and lastly enabled advantage to be taken of the diversity between the demands of different sub-stations.

The extent to which a system may be safely interconnected by the use of these devices is shown by Fig. 3, which illustrates diagrammatically the high-pressure distribution system on the north-east coast. No less than 350 sub-stations are connected to this system, and it is fed by 15 power stations, many of which utilise waste energy in the form of exhaust steam and coke-oven gas. The older feeders are equipped with balanced-current, and the more recent ones with split-conductor protection. Over a period of time, selected quite at random, faults occurred on 23 feeders equipped with automatic protection, and in 22 cases the faulty feeder was instantaneously isolated without causing

an interruption of supply to a single sub-station except in one instance where a non-duplicate supply was given. In the 23rd case one of the feeder switches failed to open, due to a mechanical fault; this was equivalent to a busbar fault, and brought out the overload gear at two sectioning points, thus limiting the trouble

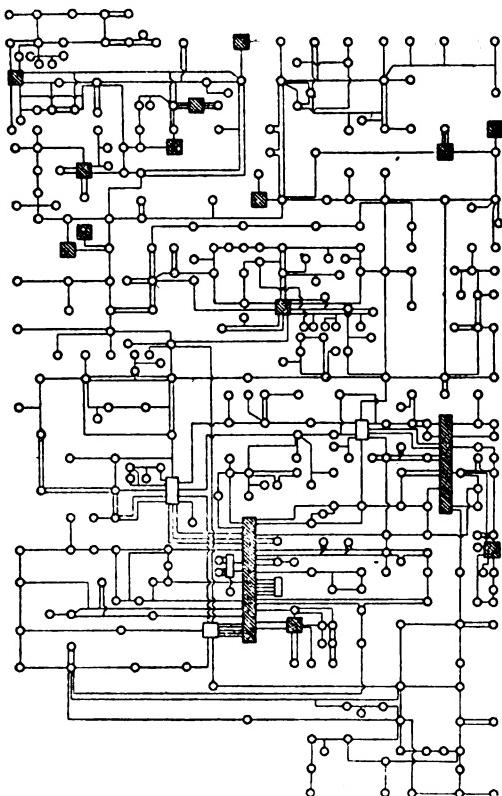


FIG. 3.—NORTH-EAST COAST HIGH-PRESSURE DISTRIBUTION SYSTEM.
(Generating stations shown cross-hatched).

to this section of the system. Actual figures were worked out to prove the author's contention that the saving is not only sufficient to balance the cost of the special protective devices, but that a system so equipped is actually cheaper than systems protected by less efficient methods.

The author concluded his Paper with a discussion of the most suitable distribution voltage.

Mr. P. V. Hunter, who opened the discussion in London, expressed surprise at the low current densities obtained in Fig. 2, which, however, were due to the high load factor taken. Mr. G. W. Partridge was disappointed that pressures above 20,000 v. for underground cables had not been dealt with in the Paper. He was himself considering the use of voltages up to 60,000. He pointed out that lower frequencies than 50 cycles per sec. had advantages. There was less trouble from inductance and capacity, lower iron losses, less danger of surges, and a greater suitability for railway supply. With lower frequencies there would also be a great future for single lead-covered cable. He endorsed the author's remarks as to the necessity for switch-gear being adequate to take the full short-circuit current, and said that he observed neglect of this in the design of almost every station he visited. He was now installing oil switches capable of dealing with 200,000 kw. Oil switches should have as many breaks as possible, and a good head of oil. Referring to the pressure of gas produced in an oil switch, he mentioned one case in which this had been sufficient to blow the switch together again. Bus bars should not merely be supported by porcelain insulators; in the latest switchboard at Deptford he was using single lead-covered cable as 'bus bars.'

Mr. B. Welbourn said that the life of mains had been underestimated by the author; 25 years was now considered a standard for underground cables, and the life of overhead mains was limited by that of the poles; the latter had been put at 35 years by evidence given by the Post Office in the recent telephone arbitration.

Mr. W. B. Woodhouse, Mr. Brazil, and Mr. E. B. Wedmore also spoke, and Mr. Beard replied briefly.

Diesel Engine Users' Association.—At the December meeting of the Diesel Engine Users' Association Mr. G. Porter, Borough Electrical Engineer at Worthing, was elected President. Messrs. C. O. Milton (Maidenhead), C. Gould (Letchworth), and H. Leslie Dixon (Leatherhead) were elected Members of Committee, and Mr. Percy Still (Chelsea) Honorary Secretary. There has been an increase in membership during the year of 19 members, the total now being 48, representing 104 Diesel engines, having a total horse-power of 23,984.

ELECTRIC RAILWAYS

THE "James Forrest" lecture for 1915 before the Institution of Civil Engineers, given on December 14th, was by Mr. H. M. Hobart; it was on "Electrical Railways," and was delivered, in the absence of the author, by Mr. J. A. F. Aspinall. The lecture dealt mainly with the growth of the high-tension direct-current system in America, a system which, as is well known, Mr. Hobart has long championed vigorously against the single-phase system. In some introductory remarks it was pointed out that whereas in 1895 only 8 miles of steam railway (single track) had been electrically equipped, there were now 3,460 miles of converted line running or in process of equipment in the U.S.A. and Canada. Including all kinds of electric railways, the total mileage had increased from 12,100 to 45,000 in the same period. The accelerated growth of the electric railway industry was in no small measure a consequence of, and had also been a contributory cause of, the continual decrease in the cost of electrical energy, and energy was now being supplied to railways on a large scale at prices in the neighbourhood of 0'26d. per kw.-hour. The relative costs of current from steam and water power were considered. The relative advantage depended largely on the load factor. While for very low load factors steam undertakings could supply electricity at the lowest cost, when we came to load factors above 0'2 the hydro-electric undertaking had the advantage, and for unity power factor the hydro-electric undertaking could supply electricity at practically half the price attainable with the steam undertaking. The influence of the variations in the cost of fuel on the total cost was also traced. Roughly, for a 150,000-kw. 11,000-volt steam station an increase in the price of coal from 4s. to 12s. per ton would increase the cost at the generating station from 0'228d. per kw.-hour to 0'302d., to which 0'18d. was to be added for cost of transmission over ten different feeders of an average length of 100 miles, or 0'08d. if all transmitted *en bloc* over one route. These and other figures were only given as broad indications of the order of magnitude involved, and it was remarked generally that higher load factors reduced the investment costs, and consequently also the total cost. The transmission of smaller quantities of electricity is associated with higher costs. Loads with a lagging power factor, unless compensated by loads with a leading power factor, can only be supplied at an increased cost. Every additional transformation of pressure, periodicity, or kind of supply increased the cost. It was an advantage from the load factor point of view and a diversity factor point of view to take power from a system supplying a mixed load rather than for a railway to "manufacture its own electricity."

The first extensive application of electric propulsion to a mountain grade railway system employing a considerable number of freight locomotives was that of the Butte, Anaconda & Pacific Railway, which was described at some length in the lecture, comprising 114 miles of single track formerly worked by steam, and now worked, all but 23 miles, electrically, employing seventeen 72-ton electric and four steam locomotives. The electric locomotives have four 1,200-volt D.C. air-cooled motors of 270 h.p. (continuous rating), connected two in series, capable of delivering 40'5 h.p. per ton of electrical equipment continuously, and developing a 48,000-lb. tractive effort for five minutes. Additional 2-motor tractor trucks can be coupled to them, and the combination can develop a tractive effort of 37,500 lb. continuously at 10'8 m.p.h. The performance of these locomotives was dealt with in the lecture at length, and it appears that whereas when steam locomotives were employed the outlay for fuel and power per loco-mile was 19'9d., the corresponding figure for electric locomotive is now only 7d. The efficiency of the electrical equipments shown by tests is from 83 to 84 per cent., and the "Pantograph-drawbar efficiency" from 77 to 81'5 per cent. The power cost per electric train-mile worked out at 62 per cent. of the outlay for fuel for the corresponding steam train. The improved economy effected by the smaller percentage of time in the repair shops of the electric locomotive and the influence of the reduced number of train crews required are also gone into. The electric locomotives in question required 2'2d. per locomotive-mile for repairs as compared with 6'5d. for the steam locomotives which preceded them.

Some particulars were also given of the Chicago, Milwaukee & St. Paul 3,000-volt lines now being equipped, and special mention was made of the advantages that would be attained by regenerative braking. The fact that ascending or accelerating trains drew their power directly from neighbouring descending or stopping trains was analogous to many additional sub-stations distributed along the route. Reference was also made to the split-phase system with a single-phase

11,000-volt contact line in use on the Norfolk & Western Railway and the locomotives of the New York Central Railway.

Comparing the progress of the single-phase and high-pressure D.C. systems in America, Mr. Hobart pointed out that there were 1,490 miles of the former running against 3,720 of the latter. After going into figures, he argued that we may take the outlay for energy about the same for the two systems, leaving the single-phase system handicapped by the greater inherent cost of single-phase locomotives. If, he continued, up to the locomotive, any material savings could have been demonstrated for the single-phase system, then the correct choice would be influenced by the density of traffic, the greater outlay per single-phase locomotive with a sparse traffic being more than offset by the savings up to the locomotive, while with a dense traffic the greater outlay per single-phase locomotives would more than offset any savings up to the locomotive. Since, however, up to the locomotive, the costs are a stand-off, it would appear that even with a sparse traffic the direct-current system is the most economical, and that the percentage by which it is more economical increases with the percentage which the locomotive investment bears to the total investment.

The conclusions of the Paper were to the effect that: 1st, we are on the eve of the extensive employment of electric locomotives on railroads at present operated with steam locomotives; 2nd, that the direct-current system is the most appropriate; and 3rd, that direct-current locomotives for use from high-pressure contact conductors are now a thoroughly demonstrated success.

COLLECTIVE POWER FOR BRITISH ENGINEERING

THE second of the informal dinners which are being arranged by the British Electrical & Allied Manufacturers' Association in connection with the attack on German trade was held on December 15th. The subject of discussion was a Paper by Mr. T. C. Elder, Hon. Secretary of the British Association of Trade & Technical Journals, who in an address on "Collective Power for British Engineering" discussed the steps which should be taken to deal with the large margin of capacity of machinery in engineering shops due to the war in order that this machinery may not be thrown upon the scrap-heap, but may be utilised to give the electrical engineering trade the right send-off when peace conditions prevail. Mr. Elder, who has almost an undisguised contempt for the Board of Trade as an instrument of commercial advancement, thinks that the first step must be made by manufacturers, and, at any rate, that the organising power must come from them in the initial stages. The necessary first step suggested is for some such Association as the B.E.A.M.A. to endeavour to induce other sectional engineering associations not to amalgamate, but to project a new common organisation for dealing with trade in its broad aspect, leaving individual associations to continue that necessary work in specialising in the affairs of their own particular branch of industry.

In this connection it is not without interest to note that the Institute of Industry is working on somewhat similar lines, but does not appear to be receiving very much encouragement from official quarters. For instance, a scheme for the creation of an industrial bank with a capital of one million pounds—it being stated that the money is available at once—has not been received with much favour by the Treasury, whose suggestion is that it should be put off till after the war. This attitude, of course, completely negatives the whole object of the steps which are being taken in various parts of the country to do something which will place British trade in a better position than hitherto to supply the world's markets, and at the same time defend it against foreign competition of the type to which it has been subjected for many years past. The difficulty at the present moment seems to be that so many people are all working more or less independently of each other with the same object in view, whilst the Board of Trade also is at work on the same lines. The most comprehensive of all these efforts seems to be that of the Manchester Engineers' Club, and whilst everyone knows precisely what is wanted, the difficulty is to evolve some scheme which will avoid overlapping and prevent a needless waste of energy on the part of many people all striving after the same object. To wait until after the war before attempting to frame a policy would be suicidal, and it needs immediate action of the sort advocated by Mr. Elder if the electrical engineering manufacturing trade is to regain rapidly the ground lost through the war.

In the discussion upon Mr. Elder's Paper there was general agreement that the Government, capital, and labour will have to give this matter earnest consideration.

STANDARD WALL PLUGS

THE Engineering Standards Committee have issued a Standard Specification for 5-ampere Wall Plugs and Sockets,* which will cause considerable surprise in many quarters. Not content with giving its *cachet* to the "universal" gauge which is adopted by the majority of consultants and contractors nowadays, they have taken the step of insisting that nothing but the hand-shield plug with wires entering at the side shall in future be standard, and have gone so far as to fix the diameter of the hand-shield at not less than 2 in.

We are strong advocates of the wall-plug with side-entering flex, and the hand-shield type with its handle at the top is certainly as convenient as any for the ordinary front-entry sockets, but we submit that to make this the one and only standard is a grave mistake. There are in use thousands of combined switches and wall-sockets by first-class makers, designed with the sockets at the lower side of the switch base for "universal" gauge plugs, and these will, in many positions, not take the plug with a 2-in. diameter hand-shield. A smaller and far neater plug with side-entering flex, which affords ample protection, is now made by at least one first-class maker; it has pins of "universal" gauge, is in every respect better than the majority of larger and clumsier hand-shield plugs, many of which are of foreign origin, and should certainly not have been left out of consideration as outside the specification.

We have one more criticism to make of the Specification before us. A large number, if not the majority, of the hand-shield plugs on the market rely to some considerable extent on the tight fit of the flex in the hole at the side to prevent the wire from pulling out of the terminals. It is a simple matter to clamp the wire down in the slot at which it enters the plug, but instead of this being definitely specified, a minimum diameter is laid down for the hole or groove, with permission only to use smaller grooves if they are intended to clamp the wire. The Committee have apparently not been aware that many people have rejected hand-shield plugs solely on the ground of the greater risk of the wires pulling out of the terminals than in the ordinary type with top-entering wires.

We would suggest that either the Specification should be withdrawn or that it should be modified at once by deleting the clause calling for a 2-in. hand-shield, and making compulsory, instead of merely permissive, the provision of a device for preventing the wires from drawing out of the terminals if the flexible cord is submitted to a sharp strain.

£350 Damages for Electric Shock.—In the Bow County Court on Wednesday his Honour Judge Smyly, K.C., gave his considered decision in the case of Attwell v. the West Ham Corporation. Attwell was engaged in the electricity department, and his duties consisted of cleaning out transformer chambers. When in one of these at work there was an unexplained explosion, and the man was severely burned, and for some time he suffered from shock. The Corporation denied liability, saying the man was engaged as one who understood electricity, and if he had taken the ordinary precautions nothing would have happened. The case was tried by a jury, who finally gave a verdict for the plaintiff for £350 damages and costs. A new trial was then applied for, on the ground that the verdict was against the weight of evidence, and the legal arguments lasted two days. Judge Smyly, however, said he failed to find any ground for interfering with the verdict of the jury. The jury had had the evidence before them, and, having decided, he could see no reason to upset the verdict. He thereupon ordered the verdict to stand, but granted leave to appeal.

Callender's Staff Service Gazette.—The December issue of the Staff Service Gazette of Callender's Cable and Construction Co., Ltd., needs but a glance for one to realise the extent to which the firm's employees have responded to the call of King and Country. Of the London office staff, 37 have already enlisted and 34 have attested under Lord Derby's scheme, whilst a further 20 offered themselves, but have been rejected. At the Belvedere works 175 have enlisted, and about 400 offered themselves under Lord Derby's scheme, and of the Anchor works staff 64 have already joined the Forces. In addition, 113 of the outside staff have gone, apart from a number who have attested, and the Uxbridge works has also contributed its quota. The Gazette, which consists of some 32 pages, is crammed full of chatty items and extracts from letters.

* For the convenience of our readers we can supply copies of the Specification at the published price of 5s. net, by return of post. Orders, accompanied by a remittance, should be addressed to the Kilowatt Publishing Co., Ltd. Tem Chambers, London, E.C.

QUESTIONS AND ANSWERS BY PRACTICAL MEN

RULES.

QUESTIONS: We invite our readers to send us questions, preferably on technical problems that have arisen in actual practice. Questions which we consider of sufficient general interest to our readers will either be replied to under "Answers to Correspondents," or replies will be invited from our readers. One shilling will be paid for the question which we select for competitive replies in this column.

ANSWERS: A fee of 10s. will be paid for the answer which we consider shows the greatest merit, and 5s. for the one we select as second best. Replies should reach this office within seven days of the appearance of the question. In judging the replies, importance will be attached to clearness and conciseness, as well as accuracy. The Editor reserves the right to make no award, or to accept only one reply, if, in his opinion, the answers received do not possess sufficient merit. Competitors desiring the return of their manuscripts, if unaccepted, should enclose stamped addressed envelope.

Write on one side of the paper only, and if diagrams are sent, draw them on a separate sheet of paper attached to the manuscript. Competitors may adopt a "nom de plume," but, both in the case of questions and answers, the competitor's real name and address must be sent with the manuscript as a guarantee of good faith. No correspondence will be entered into with regard to unsuccessful replies. The Editor's decision is final.

QUESTION No. 1,475.

In a small electric bell installation there are pushes in three rooms and a bell with a three-way indicator close to it; the wiring is metallic circuit without common return. It is desired to alter the installation by the addition of two more bells next to the existing one, and the use of a group of three pushes instead of a single push in each room, connected so that a different bell rings for each room, and the number shown on the indicator gives the number of the push used. How can this be done with the minimum alteration in wiring?

(Replies must be received not later than first post, Thursday, Jan. 6th.)

ANSWERS TO No. 1,475.

In a 3-wire A.C. 1-phase network (200 volts across outers) and the neutral not earthed, at normal times the pressure obtained from each of the outers to earth is 100 volts; the neutral, although unearthing, is at earth potential. When one of the outers develops a high resistance earth, the pressure from the unearthing pole to earth becomes 180 volts, from the earthed pole to earth 40 volts, and from the neutral to earth 50 volts. At the same time the normal pressure is obtained across the conductors. Why is this?

The first award (10s.) is given to "M. M." for the following reply:—

The apparently paradoxical condition referred to in the question is due to the fact that inductance and capacity affect the readings and considerably modify the results. With direct current we only have ohmic resistance to consider. In an alternating-current circuit we have inductance and capacity as well as ohmic resistance. It must be remembered that the fault forms a looped circuit. Plotting results as a triangle: Let the base be made to represent the resistance, while the side at right angles to the base represents the difference between the ohmic value of the inductance and the ohmic value of the capacity, it will at once be seen the voltages will, or rather may, sum up to a figure greater than the impressed potential. The explanation is that these voltages are out of phase. Tests on alternating-current systems are not generally reliable as to actual resistances of faults; they are more of a comparative nature. By noting any differences from what may be called the normal readings we can, however, get an indication of faults, although unable to give such faults a definite ohmic value.

The second award (10s.) is given to "F. H." for the following:—

It is difficult to say exactly why "Sulphur" obtains the figures given in the above question, as he does not mention what type of voltmeter he used—whether it was of the electrostatic type or not. Now, an electrostatic voltmeter has an infinite resistance and a negligible capacity, while a voltmeter of the electrodynamic type for measuring up to 200 volts may not have a resistance of more than 3,000 ohms. Further, all the voltages are given in round numbers, so that probably they were not taken with great accuracy. Even at the best, it is difficult to obtain accurate values of such voltages as 40–50 with a 200-volt A.C. instrument.

The line OA in Fig. 1 represents to scale the voltage (100) between one outer and the mid-wire, and OB represents the 200 volts between the outers. If 40 and 180 be respectively the true voltages—measured by an electrostatic voltmeter—between earth and the two outers, they will be represented by the two sides OC and OD of the parallelogram $OCBD$ in Fig. 1. The voltage between the middle wire and earth must consequently be represented by the side OE of the parallelogram $OCAE$. By measurement of OE the voltage is found to be 84, instead of 50 as given in the question; in fact, either the 40 or the 50

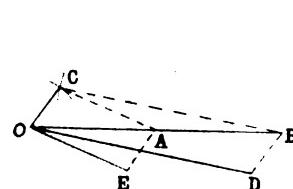


FIG. 1.

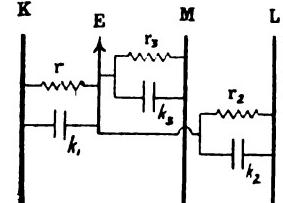


FIG. 2.

volt or both cannot be the true values, since the algebraic sum of two vectors cannot be less than their resultant, which in this case is 100 volts. The employment of another type of voltmeter, however, may be sufficient to partly explain this discrepancy.

In what follows an attempt is made to show how the phase differences indicated in Fig. 1 may be caused by the condenser action of the cables together with a poor insulation resistance between one or more of the conductors and earth. Let K , L , and M in Fig. 2 represent the two outer and the middle conductors respectively. Let r_1 and k_1 be the resistance and the capacity respectively between conductor K and earth; and r_2 , k_2 , r_3 , k_3 be the corresponding values for conductors L and M . Suppose the voltages—measured by an electrostatic voltmeter—between the conductors and earth be e_1 , e_2 , and e_3 respectively. Then, current through $r_1 = \frac{e_1}{r_1}$, and is in phase with the voltage e_1 ; whilst current through $k_1 = 2\pi f k_1 e_1$, and is 90° in front of e_1 . Further, the resultant current flowing between K and earth $= i_1 = \sqrt{\left(\frac{e_1}{r_1}\right)^2 + (2\pi f k_1 e_1)^2}$, and the angle ϕ_1 between e_1 and i_1 is given by $\cos \phi_1 = \frac{r_1}{i_1}$. (For full explanation of these formulæ and vector diagrams see Maycock's "Alternating-Current Work," Chap. II.) Similarly, the earth currents from L and M can be determined. Further, the vectorial sum of the currents at the junction of the three circuits (Fig. 2) must be zero.

To make the above still clearer, let us assume that $e_1 = 40$, $e_2 = 180$, $e_3 = 84$ (Fig. 1). $r_1 = 10,000$, $r_2 = 1,600$, $k_1 = k_2 = 5$ mfd., $k_3 = 4.5$ mfd., and $f = 50$ cycles per second. Then current through $r_1 = 0.384$; current through $k_1 = 0.063$; $i_1 = 0.389$; and $\phi_1 = 95^\circ$. These quantities are represented in Fig. 3, where OF is current through r_1 , and is in phase with the voltage Oe_1 ; OG is current through k_1 , leading 90° in front of Oe_1 ; and OH is the resultant current 95° in front of Oe_1 . Similarly it is found that $i_2 = 0.284$; $\phi_2 = 86.5^\circ$; $i_3 = 0.13$; and $\phi_3 = 66^\circ$.

We can now draw the vector diagram for the currents. Thus, OA in Fig. 4 is the vector of the mains voltage, as in Fig. 1. OP represents i_1 , 95° in advance of OC in Fig. 1; and OQ and

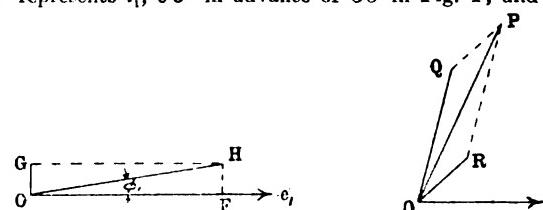


FIG. 3.

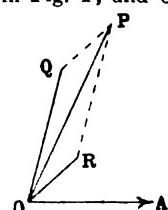


FIG. 4.

OR represent i_2 and i_3 , being respectively 86.5° and 66° in front of OD and OE . The values have been so chosen that $OPQR$ forms a parallelogram; i.e., the resultant of the current flowing between L and M and earth is equal to that flowing between K and earth.

Using a voltmeter of a type other than the electrostatic is equivalent to inserting a high resistance such as r_2 in the circuit, though the insulation resistance of that particular conductor may be perfect. This causes the distribution of the voltages e_1 , e_2 , and e_3 to be upset in different directions when the readings are being taken successively by the same instrument, and may partly explain the discrepancies observed in the figures given in the question.

It may be pointed out that the only effect of an earth on the mid-wire, with perfect insulation on the outers, is to cause the former to be maintained at zero potential, there being neither an alteration in the symmetry of the voltages to earth nor any current flowing through the fault.

"ELECTRICAL ENGINEERING" PATENT RECORD

(This Patent Record is compiled by our own Editorial Staff and is Strictly Copyright.)

Specifications Published Dec. 23rd, 1915

A full list of electrical patents published last week appeared in our last issue. The following are abstracts of some of the more important specifications.

Names in italics indicate communicators of inventions from abroad.

4,345/14. High-frequency Currents. Soc. MARIUS LATOUR ET COMPAGNIE. Production of high-frequency currents for wireless telephony and telegraphy by transformation of polyphase currents at n/f cycles into polyphase current at $(n+2)/f$ cycles by a dynamo-electric machine having a polyphase winding on its stator, and a single-phase winding on its rotor, the polyphase winding being fed at n/f cycles. (One figure.)

23,171/14. Motor Control. A. H. CURTIS, W. SHORT, and IRANIC ELECTRIC CO., LTD. A control system for operating two motors at equal speeds wherein the field windings are connected in a common series circuit and in series with a controlling resistance, and the armatures are connected in parallel with a circuit comprising the field windings and any selected part of the series controlling resistance. (Six figures.)

23,749/14. Protective System. J. F. WATSON, E. G. WATERS, and CALLENDER'S CABLE & CONSTRUCTION CO. A protective system for ring mains, &c., having an arrangement of pilot conductors and relays for each section so interlocked that while normally there is no complete circuit either electrical or electro-magnetic through any one of the protective conductors, current derived by one conductor from the system through leakage which virtually establishes the circuit of a companion relay controlling a switch at one place will, through such relay, cause current to be conducted to another relay controlling a switch at a distant point. (Six figures.)

1,088/15. Incandescent Lamps. B.T.-H. CO., LTD. A method of freeing lamp bulbs from occluded gases in which the bulb is made of a material of high melting point and is heated during exhaustion to a temperature slightly below that at which deformation due to softening would occur, and continuing the exhaustion at a considerably higher temperature.

Specifications Published To-Day

The following Patent Specifications will be published to-day, and will be on sale at the Patent Office Sales Branch, 25, Southampton Buildings, London, W.C., at the price of 6d. each, including inland postage.

Summaries of some of the more important of these Patents will appear in our next issue.

Distributing Systems, Cables and Wires, Insulating Materials, &c.: BOWDEN and THOMPSON [Protection of cables] 4,585/15.

Incandescent Lamps: SIEMENS & HALSKE A.G. [Vacuum regulation] 14,918/15.

Instruments and Meters: LANDIS & GYR SOC. ANON. [Prepayment meters] 24,013/14; BLATHY [Brake magnets for meters] 24,543/14; HIKELEY [Integrating wattmeters] 1,483/15.

Telephony and Telegraphy: VREELAND [Production of undamped oscillations] 11,555/15.

TELEPHONY AND TELEGRAPHY (INCLUDING WIRELESS)

The annual report of the Pacific Cable Board for the year to March 31, 1915, shows an excess of receipts over expenditure of £78,686, which is greater by £12,035 than the figure in the previous year. Owing to the interruption of the Fanning Island cables, due to a raid by the German cruiser *Nürnberg* in September, revenue to the extent of £50,000 was lost. The amount to be provided by the Imperial and Dominion Parliaments is £7,915. Some interesting details are given in connection with the attack by the German cruiser. It appears that the ship approached the cable station flying the French flag and landed a party, who arrested the superintendent, surrounded the station, and trained a machine gun on the office buildings. Having made prisoners of the staff, the instruments were attacked with axes, the engine-house and lighting plant was wrecked by dynamite, and the cables damaged by dynamite at low-water mark, in addition to being cut at about 600 yards from the shore and dragged out of position. The staff had been able to submit brief intelligence of the occupation to Bamfield and Suva before the enemy entered the instrument-room and cut off communica-

Traction: IRVING [Signalling] 229/15.

Miscellaneous: ALLISON and WALLER [Mine signalling] 23,550/14; CLEUET and BOUVEUIL [Ringing apparatus with polarised electromagnets] 23,563/14; GREENE and BRITISH TABULATING MACHINE CO. [Electrical tabulating machines, &c.] 23,566/14; LABOURNE [Mine signalling] 23,743/14; HISLOP [Contact makers for fire alarms] 3,860/15; Ross [Combined hydraulic and magnetic power apparatus] 8,742/15; HOLLAND and BECKER [Mine signalling] 9,777/15.

The following Specifications are open to Inspection at the Patent Office before Acceptance, but are not yet published for sale.

DYNAMOS, &c.: GIRARDEAU [DYNAMOS] 16,928/15.

Instruments, &c.: CUTLER-HAMMER MNF. CO. [Resistance thermometers] 15,124/15.

Switchgear: A. G. BROWN, BOVERI ET CIE [Maximum time limit relays] 14,498/15.

Miscellaneous: DR. ING. SCHNEIDER & CO. ELECTRICITÄTS GES. [Pocket lamps] 15,863/15.

Avoidance or Suspension of Enemy Patents

15,128/11. Electrometallurgy. SIEMENS & HALSKE A.G. An application by the Refractory Zinc Ore Treatment Co. will be heard on Dec. 30th. The patent relates to the construction of anodes for zinc reduction of manganese dioxide with the addition of lead peroxide to improve the conductivity.

Amendment applied for

7,235/11. Electrometallurgy. U. C. TAINTON and J. N. PRING. Leave is sought to omit a claim and make other verbal alterations in this specification which describes a process of electrodeposition of zinc, using an electrolyte containing a large proportion of acid, a small proportion of a celloid or gum, and a zinc salt. The claim in question covers the use of this electrolyte in secondary batteries with zinc electrodes as well as for electrolytic purposes.

Amendment allowed

9,282/15. Dynamos. W. LANGDON-DAVIES and A. SOAMES. Leave has been granted to include the name of the Naamlooze Vermoetschap de Nederlandische Thermo Telefoon Maatschappij as an applicant. The application deals with the driving of dynamos, and is not yet accepted.

Expiring and Expired Patents

The following Patent expires during the current week, after a life of fourteen years:-

361/02. Electric Traction. W. M. BROWN. An improved stud for surface contact tramways.

The following are the more important Patents that have become void through non-payment of renewal fees.

Miscellaneous: G. B. BOWELL [Electric clocks] 20,496/09; W. D. WHYTE [Magnetic compasses] 20,537/09.

tion. Immediately the German cruiser departed, steps were taken to restore temporary communication, and remarkable ingenuity and skill were displayed. An ordinary pickaxe was adapted to the purpose of a grapple, and by this means the heavy shore end was partially raised. One of the operators, Mr. Hugh Grieg, is specially mentioned in this connection. He worked under the sea, and secured the end of the cable, thus enabling it to be raised above the sea-level. The special services rendered by Mr. Grieg and the other members of the staff have been suitably rewarded by the Board. Temporary connection was made between the two ends of the cable by means of ordinary covered wire, the fact that the Germans had towed the two ends widely apart making it impossible to bring them together without more suitable apparatus. The fault was eventually repaired by the cable ship *Kestrel*. The replacement of the apparatus, buildings, and plant involved an expenditure of about £5,000.

In notifying the 7 per cent. preference dividend and an interim dividend of 5 per cent. on the ordinary shares, the directors of the Marconi Wireless Telegraph Co., Ltd., express regret that they have not yet been able to obtain from the Government Departments concerned a basis of settlement in respect either of remuneration or compensation for services rendered, for the use of their stations, since the commencement of the war, nor in respect of other matters in which the Government is indebted to the Company. Without taking these matters into account, however, the directors feel justified in declaring the dividends mentioned above.

CATALOGUES, PAMPHLETS, &c., RECEIVED

EDISWAN LAMPS.—A new list of Royal Ediswan drawn wire filament lamps has come from the Edison & Swan United Electric Light Co., Ltd. (Ponders End, Middlesex). In addition to the ordinary shapes of filaments and bulbs, there are several forms of the "Downlite" reflector lamp with separate reflectors. These reflectors are easily attached and secured by an adjustable sleeve, so that the lamp can be used at any angle as may be required for concentration of light. The polar curve shows that the increased downward candle-power with the use of the opal reflector is approximately 75 per cent.

A COMBINED WATER SOFTENER AND HEATER.—From the Lawrence Patent Water Softener & Sterilising Co., Ltd. (Parliament Mansions, Victoria Street, S.W.), we have received a pamphlet relating to a combined water softener and heater, for which considerable advantages are claimed.

TURBINE-DRIVEN CENTRIFUGAL PUMPS.—The turbine-driven centrifugal pumps manufactured by Messrs. Willans & Robinson (Victoria Works, Rugby) are described in considerable detail in a pamphlet just to hand. Whilst the design of these pumps renders them equally suitable for ship or land purposes, it has been influenced chiefly by the more rigorous requirements of the marine practice.

Readers desiring copies of catalogues or pamphlets should apply to the firms in question, referring to the notice in "Electrical Engineering."

METAL FILAMENT LAMPS.—The London & Rugby Engineering Co., Ltd. (36-37 Queen Street, E.C.), have issued a new price list of incandescent lamps, including the "White Star" drawn wire metal filament and the "Rugby" carbon filament lighting and radiator lamps. The metal filament lamps are made from 20 to 30 volts, and 4 candle-power, up to 260 volts, and 170 candle-power for ordinary purposes. They are also made in candle or tubular bulbs and as radiator lamps. There is a similar range in the carbon filament lamps.

FINISHING CUTTER.—With the title of the "Gauge-All," Messrs. Vislok, Ltd. (3 St. Bride's House, Salisbury Square, London, E.C.), has introduced an expandable double-ended finishing cutter for internal work, which should have a wide field of application under present conditions.

EXTENSIBLE LADDERS.—From Messrs. J. Heathman & Co. (Parsons Green, Fulham, S.W.) we have received a list dealing with their numerous types of ladders, &c.

CALENDARS, &c.

Our Editor and Assistant Editor have to thank Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., for once more presenting them with copies of the now familiar diary and pocket-book, the 1915 copies of which have done such good service.

The Bastian Electric Heating Syndicate, Ltd. (185 Wardour Street, London, W.), is sending to its friends a neat celluloid pocket rule marked in inches and also in metres. Attached is an adjustable calendar.

The Electric Construction Co., Ltd. (London and Wolverhampton), have sent us a useful pocket diary for 1916 in a roan leather case.

A celluloid calendar for 1916, measuring 4 ins. by 2½ ins., and bearing a metric as well as an inch scale, is being distributed by the Key Engineering Co., Ltd. (4 Queen Victoria Street, London, E.C., and Manchester).

A large wall calendar for 1916, containing one sheet for each month, the figures white on a black ground, has been received from the British Thomson-Houston Co., Ltd. (Rugby). Each page also gives the previous and succeeding monthly calendar, whilst typical pictures of the British Thomson-Houston works adorn each sheet.

British Industries Fair.—The Board of Trade have now completed arrangements for holding a British Industries Fair at the beginning of next year on lines similar to those which characterised the Fair held at the Royal Agricultural Hall, London, in May this year. The 1916 Fair, which will be opened on Monday, Feb. 21st, and remain open until Friday, March 3rd, will be held in the buildings of the Victoria and Albert Museum, South Kensington, London, S.W. Only British manufacturers will be permitted to exhibit, and as the trades decided upon include glassware, no doubt manufacturers of shades, &c., for electric fittings will find it worth while to exhibit.

A NEW FERRANTI CATALOGUE

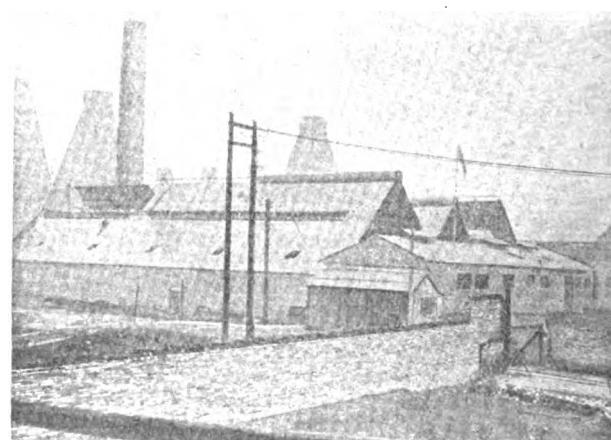
A NEW complete catalogue which has been in preparation for some time past by Messrs. Ferranti, Ltd., Central House, Kingsway, W.C., is now published. It is a comprehensive list divided into eight sections, dealing with house-meters, heating and cooking appliances, transformers, instruments, switchgear, controllers, panels, and sundries. At the beginning of each section is an index and discount sheet giving the dates of issue of the various lists, the discounts, and the advances in price (if any) on previous lists, as well as general conditions of sale. The section on meters includes continuous-current ampere-hour meters for two-wire or three-wire systems and watt-hour meters for two-wire systems, also alternating-current watt-hour meters for various systems of supply. A general description of the meters is given, with diagrams of connections and useful notes on their operation. The list of heating and cooking appliances comprises cone fires, bar fires, cooking discs, boiling plates, grills, ovens, water heaters, and utensils of various kinds, as well as large combined cooking equipments. The heating elements are illustrated and described, and full instructions given for replacing faulty elements or sections of each apparatus. Some useful general notes on the subject of electric heating and cooking are also included.

The section on transformers is mainly descriptive of Ferranti's well-known types. Their standard transformers are all of the core type. Prices can, of course, hardly be given in a list, and these are quoted on application. The next section describes a large selection of instruments, including ammeters and voltmeters of the moving coil, moving iron, and induction types, ampere-hour and watt-hour meters for switchboards, various types of relay, and instrument transformers. The switchgear list is also well illustrated, and describes all the usual varieties, both air and oil switches, as well as fuses of different types. Oil switches of a fairly large size are listed—up to 300 amps. at 6,000 volts, and 100 amps. at 15,000 volts. The controller section is devoted chiefly to starters for continuous-current motors. The division on panels covers starting panels for A.C. motors, and E.H.T. ironclad panels for interlocked, semi-interlocked, and non-interlocked switchgear. Under the heading of sundries are included plugs and sockets for voltmeters and synchroscopes, cable sockets, cable adaptors, equaliser and regulator pillars, and the Ferranti-Field protective gear for three-phase systems with earthed neutral.

The various sections of the catalogue are indexed by projecting tabs, and are neatly bound together in a handsome leatherette binder.

EXTENSIONS TO G.E.C. GLASSWORKS

OUR illustration shows the Lemington Glass Works of the General Electric Co., Ltd. (67 Queen Victoria Street, E.C.), where the bulbs for Osram and Robertson lamps are produced. The particular point of interest is that, owing to the con-

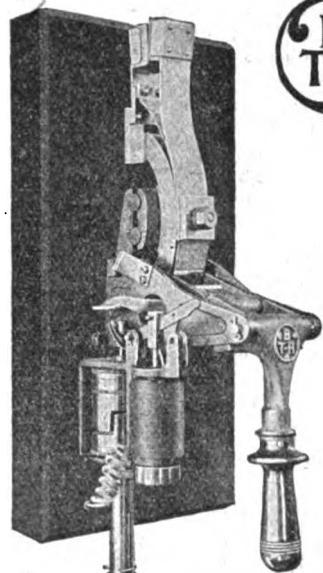


LEMINGTON GLASS WORKS, G.E.C.

tinued increase in the demand for these lamps, considerable extensions have become necessary. As will be seen, these are actively in progress. A full description of the works appeared in ELECTRICAL ENGINEERING, Vol. X., Sept. 10th, 1914, p. 499.

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TENDERS INVITED AND PROSPECTIVE BUSINESS

Generating Stations, Sub-Stations, Mains, &c.

Greenock.—A loan of £40,000 is to be applied for by the Electricity Department.

Manchester.—The Electricity Committee require a low-tension switchboard for the Stuart Street power-house. Chief Electrical Engineer. January 5th.

Newton-in-Makerfield.—Some electrical plant is required for the Gasworks. Manager. January 3rd.

Wiring

Darlington.—Electric lighting of Chilton Lane Primitive Methodist Church. Particulars from Wm. Blenkin, 29 Albert Street, Windlestone, Ferryhill.

London: Mile End.—Electric lighting of St. Benet's Church.

The following particulars relate to new buildings about to be erected, or important alterations and extensions in existing buildings. Wiring contractors are recommended to make inquiries to ascertain whether electrical work will be required.

London: St. Pancras.—New hotel at King's Cross.

Miscellaneous

London: Hampstead.—The Council require one or three years' supplies of electrical engineer's stores. Town Clerk. January 6th.

TENDERS RECEIVED AND ACCEPTED AND ORDERS PLACED

Aberdeen.—The tender of Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of Wotan, Tantalum, and carbon filament lamps to the Aberdeen Steamship Company for the year 1916.

London.—The tender of Siemens Bros. Dynamo Works, Ltd., has been accepted for the supply of Wotan and carbon filament lamps to the Royal Mail Steam Packet Company during twelve months from January 1st, 1916.

APPOINTMENTS AND PERSONAL NOTES

Mr. R. Allan Brown has been appointed Borough Electrical Engineer at Falkirk in succession to Mr. Harold Ranson, who recently resigned to join the Forces.

The War Department, Military Camps, Southern Command, require Shift Engineers, Station Fitters, Wiremen, and Engine-drivers. (See an advertisement on another page.)

The Newcastle-on-Tyne Corporation Tramways want Sub-station Attendants. (See an advertisement on another page.)

NEW COMPANIES

ELECTRODE COMPANY OF SHEFFIELD, River Don Works, Sheffield. Capital £40,000. To manufacture, buy, sell and deal in carbon and other electrodes used in connection with electric furnaces, &c. The first directors are D. Vickers, and W. Clarke (Vickers, Ltd.), H. Peile (Newcastle Alloy Co.), W. H. Ellis (John Brown & Co.), F. C. Fairholme (Thomas Firth & Sons), J. B. Milne (Hadfields, Ltd.), C. W. Kayser (Kayser, Ellison & Co.).

S. G. LEACH & CO., 15-17 Artillery Lane, E.C. Capital, £20,000. Electrical engineers, &c.

TELEPHONE MANUFACTURING CO., Hollingsworth Works, West Dulwich. Capital £25,000.

Price of Copper.—Messrs. George Smith & Son, of 5 Philpot Lane, E.C., inform us that the price of electrolytic copper bars, c.i.f. port of arrival, quoted on Tuesday night was £106 to £108 (last week, £100 to £101).

LOCAL NOTES

Bath: Electricity Accounts.—There was a net profit of £11,439 upon the working of the electricity undertaking for last year, and after taking into account the balance in hand and meeting capital charges, as well as writing off £398 to meter suspense account, decreased value of stores, and charging the wages of permanent workmen engaged on capital work, there is a balance to be carried forward of £1,767. The total number of units sold was 2,006,138, the maximum demand being 1,238 kw.

Dover: Loss on Electricity Undertaking.—It is estimated that the loss on the electricity undertaking for the current financial year will be £2,090. The estimate at the beginning of the year showed a loss of £595, but the restricted lighting conditions have increased this deficiency.

Haslingden: Cost of New Services.—The Electricity Committee has decided that during the continuance of the war—the Corporation having exhausted their borrowing powers in respect of services—the cost of all new services must fall on the consumer except in special cases.

Leeds: Half-Year's Accounts.—For the half-year to September 30th the revenue of the electricity undertaking shows an increase of £6,420 compared with the corresponding period of 1914. Against this, however, has to be put an increase of £8,678 for increased working expenses and £6,307 increased capital charges. The actual deficit for the half-year is £15,252 against £11,686, but there is nothing abnormal in this fact, it having been the invariable experience that a deficit has occurred in the summer half of the year.

Loughborough: Half-yearly Accounts.—The half-yearly accounts of the electricity undertaking show a loss of £1,046. It is to be explained, however, that this is not so satisfactory a test of the condition of the undertaking as the annual accounts. There has been a largely increased output for power purposes, which, being sold at a low rate, does not assist the financial position as lighting, which has not expanded in proportion.

Melbourne: Assisted Wiring.—The City Electrical Engineer has been instructed to report upon a scheme for wiring premises on a system by which the cost will be repaid in monthly instalments. The reason for this proposal is that inquiries have shown only 25 per cent. of the buildings in Melbourne are lighted electrically. There are some objections to the scheme, first on the ground that companies who have carried out this form of assisted wiring have almost in all cases been unsuccessful, and secondly, on the ground that it involves competition by the Corporation with wiring contractors.

Weymouth: Electricity Accounts.—The accounts for the year ended March 31st, 1915, show that although there was an increased output of 57,000 units, the loss on the year amounts to £252. This, however, has been met out of the reserve fund. The Electricity Committee report that the prospects of the undertaking until the outbreak of the war were very promising, but that the present conditions give little hope of financial success until the war is over.

COMPANIES' DIVIDENDS, REPORTS, MEETINGS, &c.

Victoria Falls & Power Co.—By declaring a 10 months' dividend at the rate of 6 per cent. per annum, less tax, on the preference shares, the arrears of these dividends have been cleared up to the end of February this year.

Companies struck off the Register.—The following have been struck off the Register of Joint Stock Companies:—Collieries Electric Power Development Syndicate, Hydro-Electric Lift & Crane Co.

Russian Electrical Development.—The Electrical Manufacturers Co. of Great Britain, Ltd., has been formed with a nominal capital of £12,000 in £1 shares to develop electrical enterprises in Russia. This Company is a combination of Messrs. Bruce Peebles & Co., Crompton & Co., Lancashire Dynamo & Motor Co., Allen, West & Co., Brook, Hirst & Co., Eckstein, Heap & Co., and Whipp & Bourne. The first directors are J. H. Bunting, E. H. Reeves, H. C. Siddeley, V. J. Moggridge, J. A. Hirst, A. Eckstein, and S. Whipp. The registered address is 28 Victoria Street, S.W.

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ELECTRICAL ENGINEERING

WITH WHICH IS INCORPORATED

THE ELECTRICAL ENGINEER

(Established 1884)

NO. 419 [VOL. XI., NO. 1]
Registered as a Newspaper.

THURSDAY, JAN. 7, 1915.

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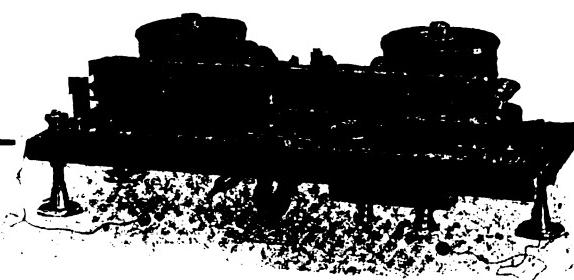
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R. Brightwell, 107, Queen's Road, Bayswater, W.
 (2172 Paddington).
 Electrical Installations, Ltd., 27 and 8, Martin's Lane, Cannon Street, E.C.
 Lund Bros. & Co., 78 and 80, Queen Victoria Street, E.C.
 (1219 Central).
 Rashleigh Phipps & Co., 147, Oxford Street, W.
 (7906 Gerrard).
 Rawlings Bros., Ltd., 82, Gloucester Road, Kensington, W.
 (3870 Kensington).
 Speedy, Eynon & Co., 6, Duke Street, Adelphi, W.C.
 (8967 Central).
 Trollope & Colls, Ltd., 77, Grosvenor Road, S.W. (1971 Victoria),
 also 5, Coleman Street, E.C., and at Dorking, Surrey.
 F. Troy & Co., 194-196, Finchley Road, N.W. (opposite
 L. & N.W. Railway Station). (3161 & 3162 Hampstead).

BRIGHTON.—Page & Miles, Ltd., 60, Western Road.

BURNLEY.—Simpson Brothers, Curzon Street.

CARDIFF.—R. Nance, 2, Dock Chambers.

OROYDON.—Thos. Hyde & Co., 180, London Road. (542 P.O.).

GLASGOW & DISTRICT.

Wm. McWhirter & Son, 212, 214, & 216, Holm Street.

HULL.

Alexander Shaw, 66 & 68, Brook Street.

WOLVERHAMPTON.—Wolverhampton Electric Fittings & Installation Co., 28, Darlington Street.

The charge for insertion in the above list is 5s. per quarter (prepaid).

Only names of Wiring Contractors of good repute are accepted.

Applications should be addressed to "Electrical Engineering," Temple Chambers, London, E.C.

In the High Court of Justice, Chancery Division.

GRIP FITTINGS FOR CONDUITS.

READ v. STELLA CONDUIT CO.

NOTICE IS HEREBY GIVEN that the judgment recently given in the above-mentioned action is now under appeal.

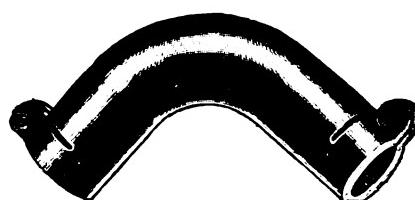
All persons making or dealing in Fittings for Electric Conduits are hereby warned that we claim that the Stella Grip Fittings and any other Fittings of similar construction are infringements of our patent No. 18375 of 1905 and that we shall take proceedings against any person making using or selling such fittings as infringe that patent.

(Signed) THE WALSALL HARDWARE MFG. CO.

WALSALL.

SETTLED.

M. D. WARMINGTON,
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 Lincoln's Inn.
December 3rd, 1914.



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Fig. A 1729.

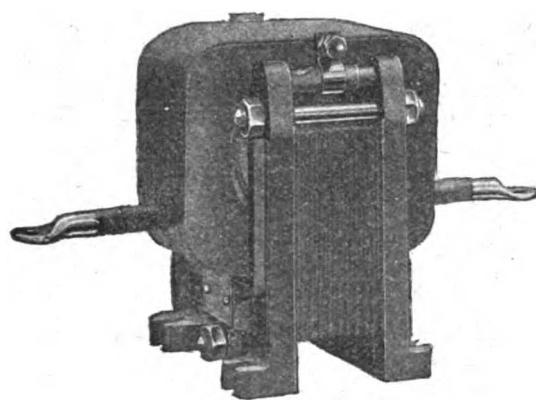


Fig. A 1360.

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Interchangeability.

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Overload.

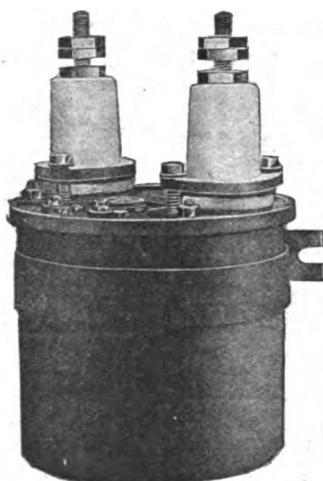


Fig. A 1420.

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APPOINTMENTS VACANT.**CITY OF BIRMINGHAM.****Electric Supply Department.****APPOINTMENT OF SHIFT ENGINEER.**

APPLICATIONS ARE INVITED for the position of Shift Engineer at the Chester Street Generating Station, Aston Manor.

Applicants must have had a sound mechanical and electrical engineering training, and must have had previous experience of a similar kind in a large electric generating station from which extra-high-tension, three-phase and low-tension direct-current supplies are given.

The commencing salary will be £104 per annum, rising at the discretion of the Committee to a maximum of £200 per annum.

Applications, made on Forms which can be obtained from the SECRETARY of the Electric Supply Department, and accompanied by not more than three Testimonials as to experience, ability and character, must reach the undersigned not later than Monday, January 18th, 1915.

R. A. CHATTOCK,

City Electrical Engineer and Manager.

Electric Supply Offices,
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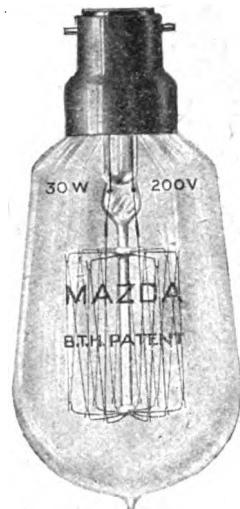
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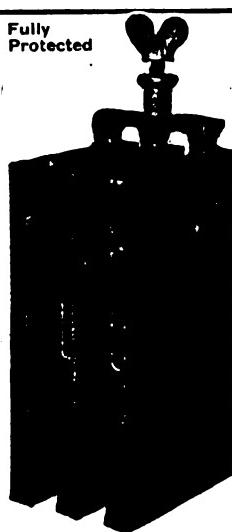
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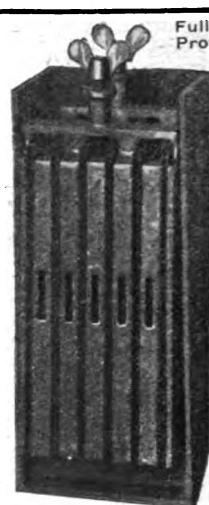
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Such statements are absolutely false, and are circulated either in ignorance of the facts, or with a view to damaging our reputation as a British firm; and we quote herewith the contents of a circular letter we addressed to the Electrical Press early in August last, shortly after the outbreak of WAR.

To the Editor,
Sir,

We should like an opportunity of correcting erroneous statements which have been made in various quarters to the effect that our stocks are dependent on Continental supplies, and that we act as "distributors" for German manufacturing firms.

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WARNING.

If, after this date, such statements be repeated and the names of the originators be brought to our notice, we shall immediately institute proceedings for Libel and Damages.

Any assistance given us by our numerous friends in the Trade towards tracing the originators of such libellous statements will be much appreciated; and will be adequately rewarded if a conviction is secured.

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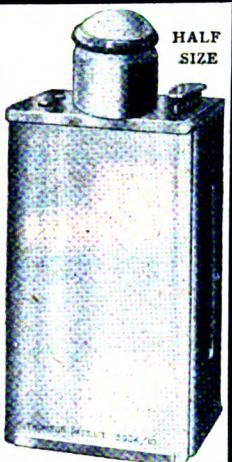


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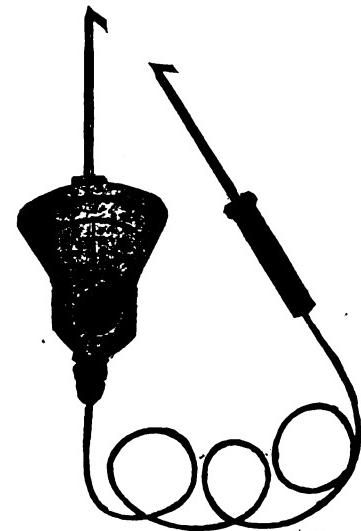
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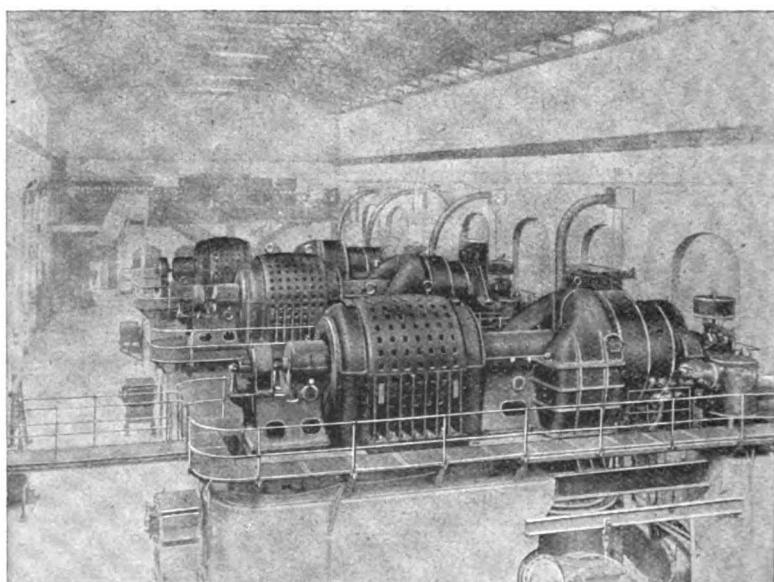
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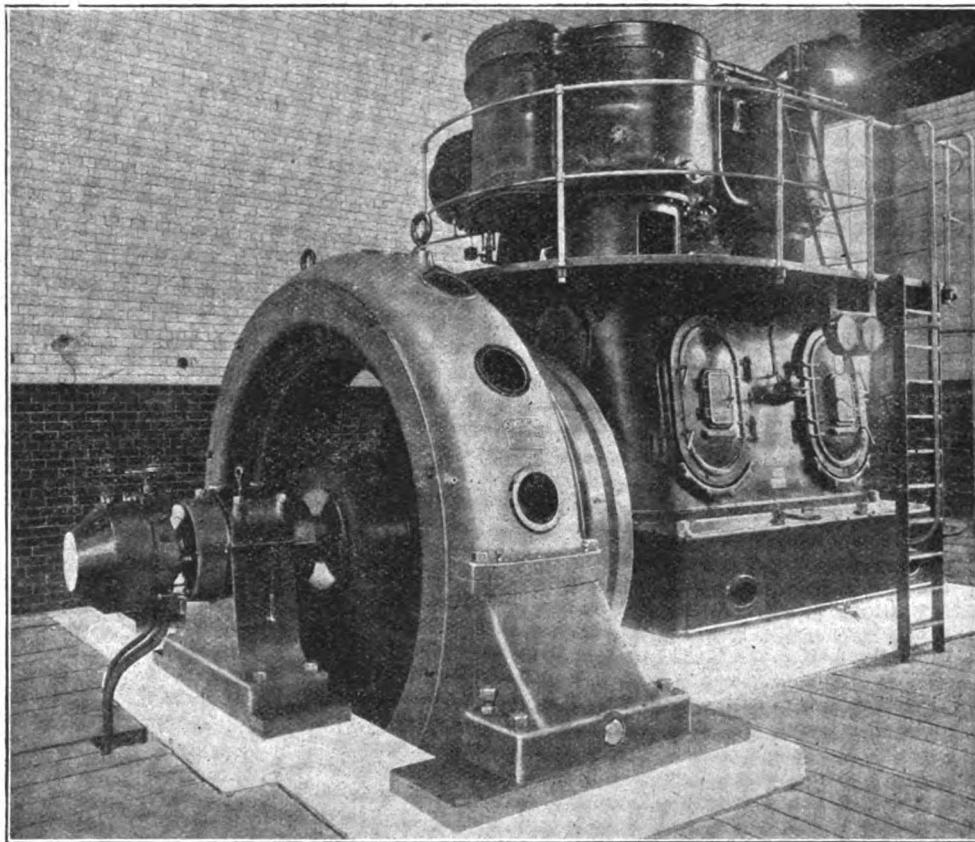
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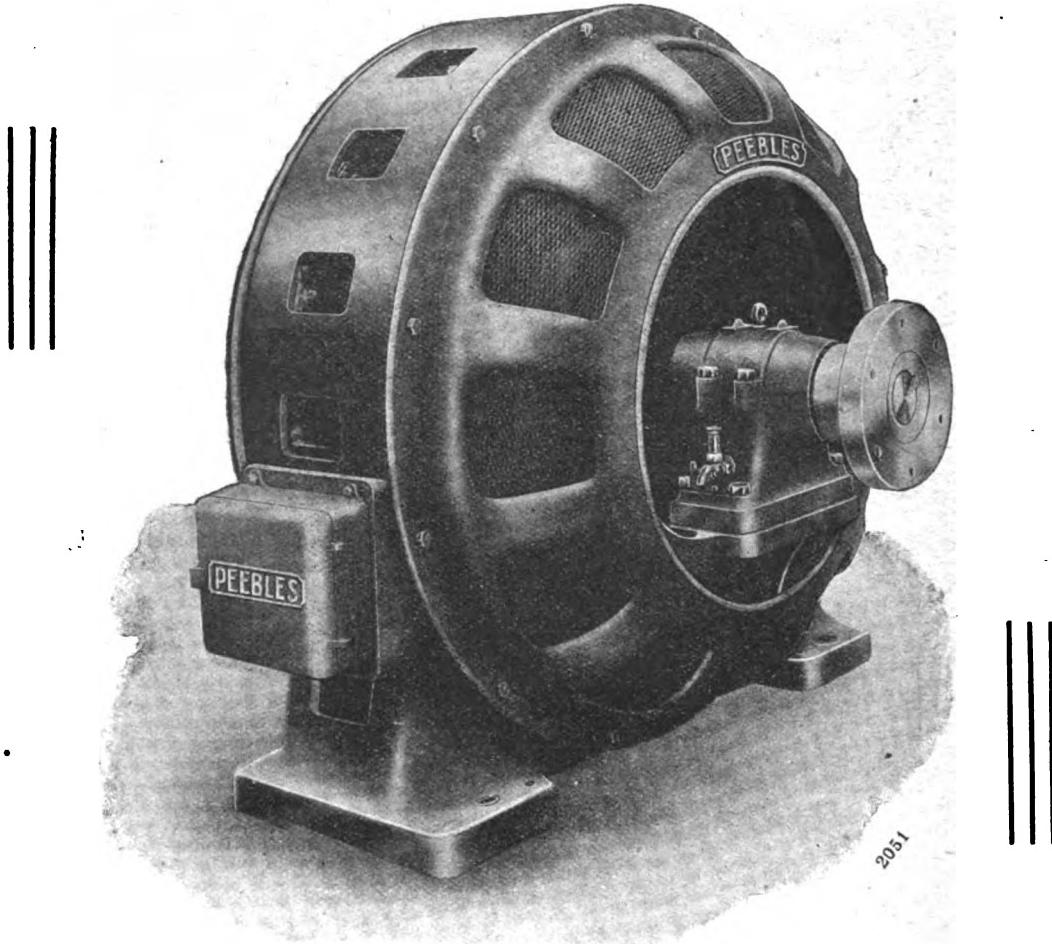
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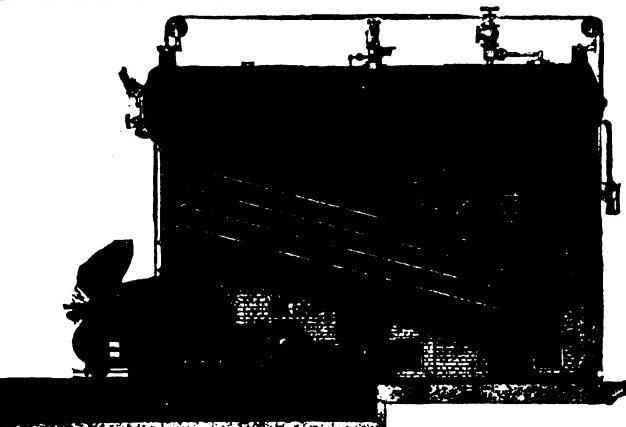
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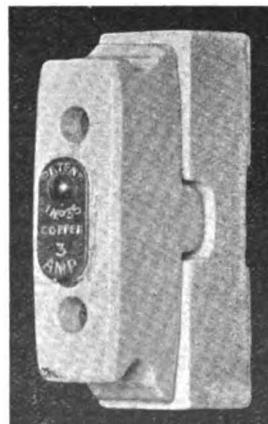
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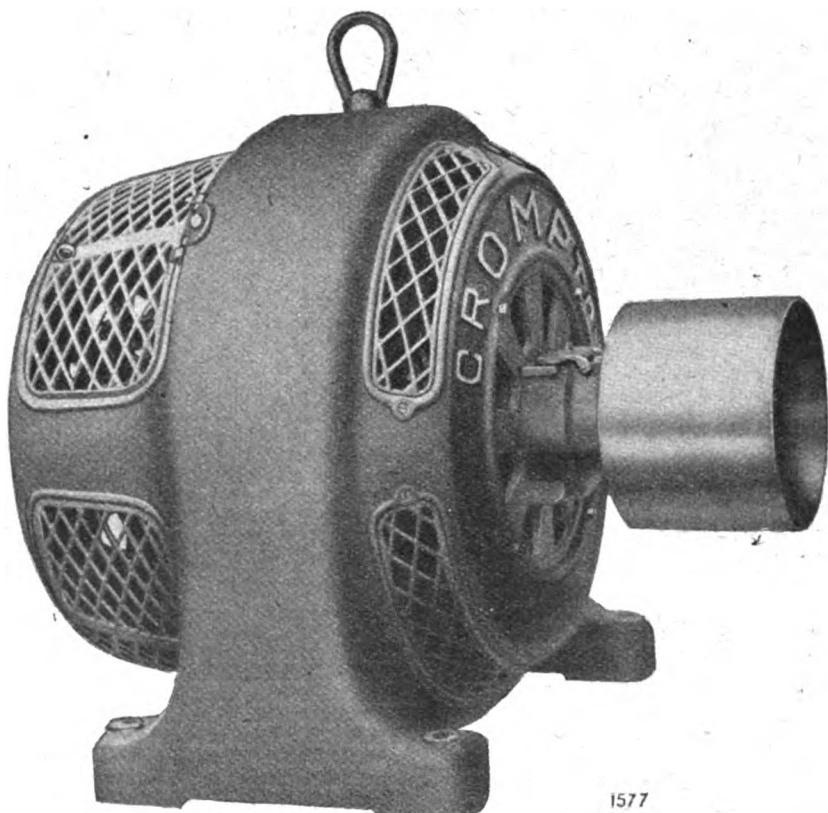
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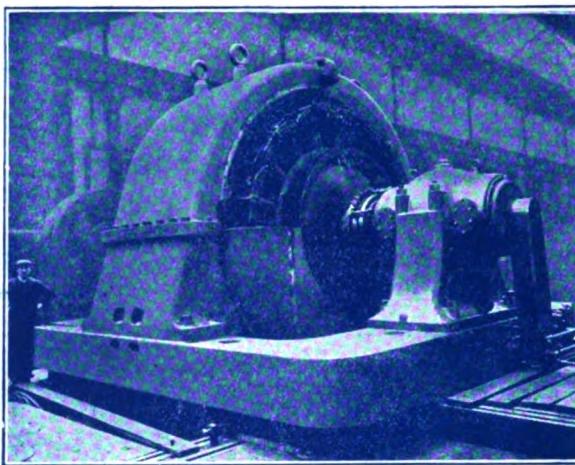
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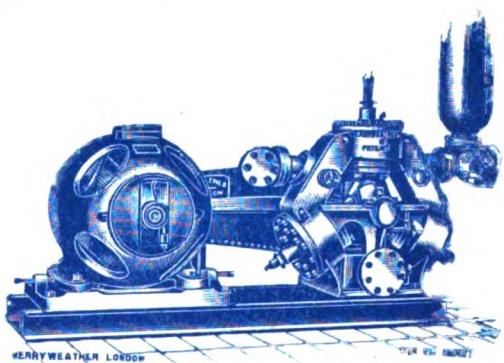
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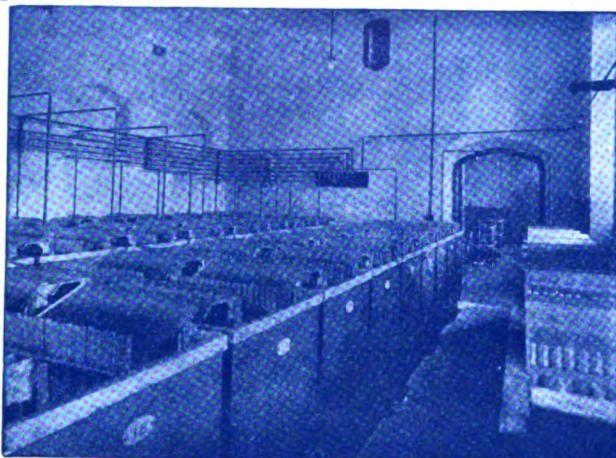
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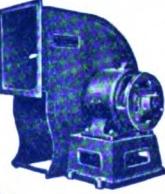
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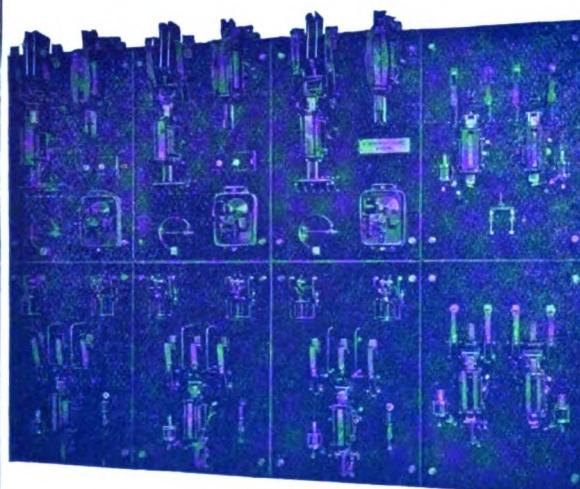
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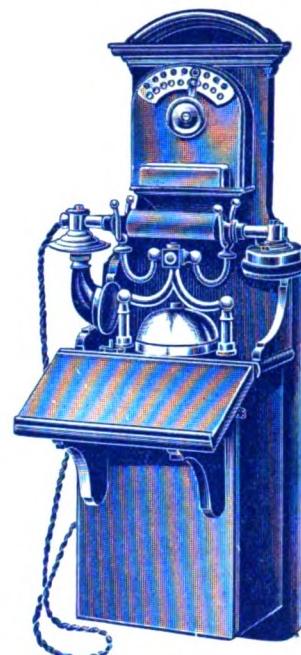
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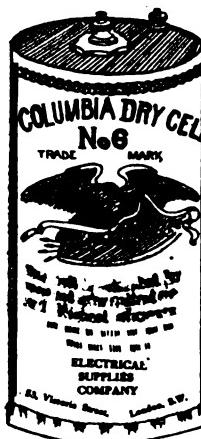
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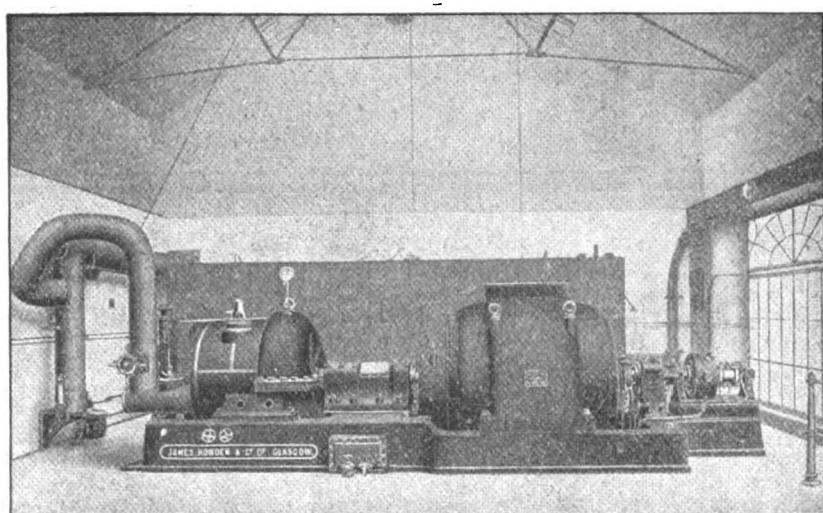
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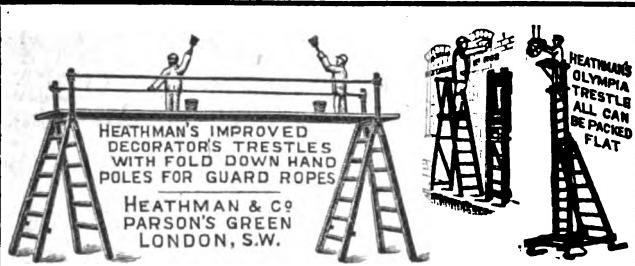
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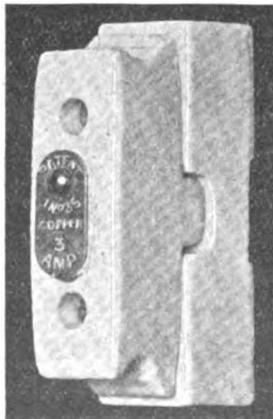
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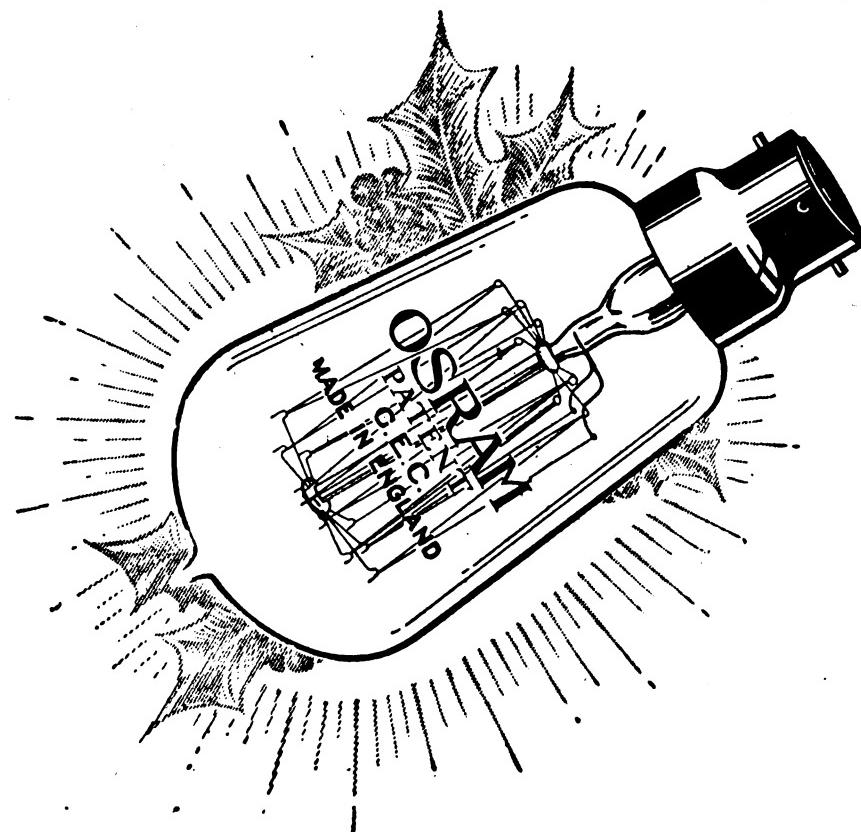
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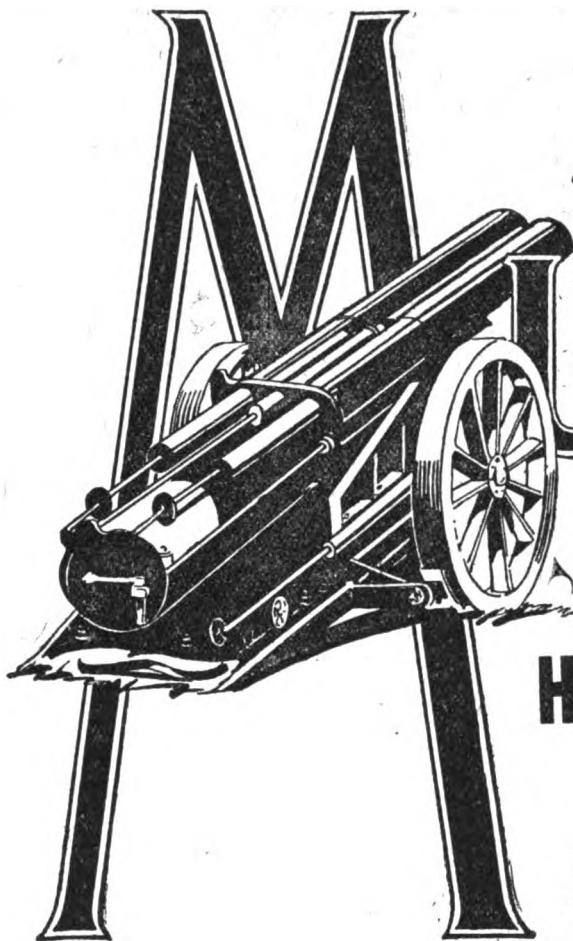
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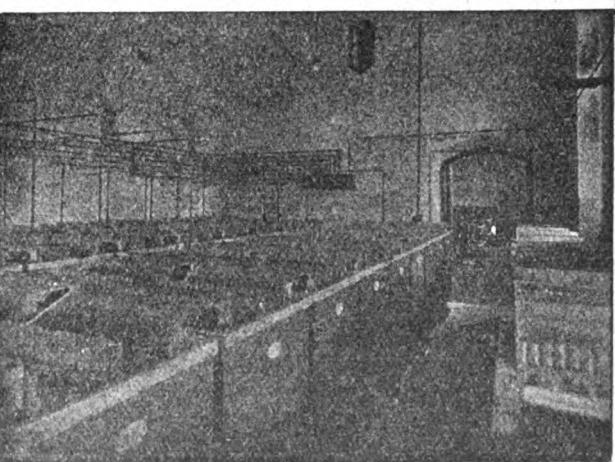
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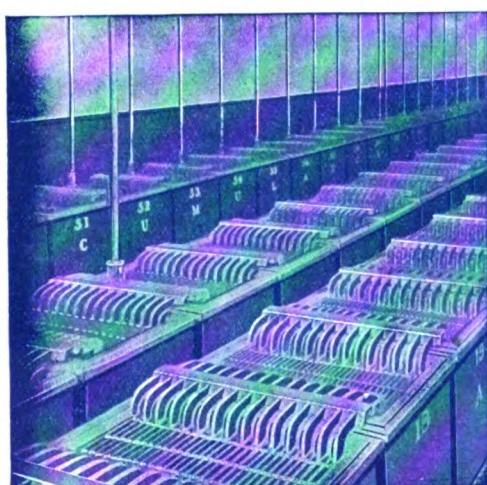
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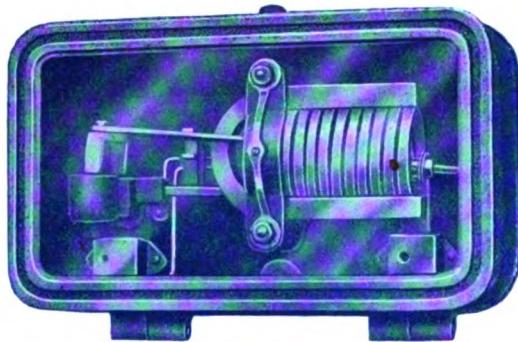
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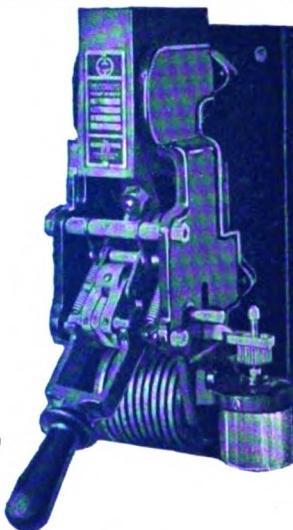
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